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# MINERALOGICAL ABSTRACTS

Vol. 15—No. 1 March 1961

## AGE DETERMINATION AND ISOTOPE MINERALOGY

AFANASIEV (G. D.), KOJINA (T. K.), & STARIK (I. E.).

*Results of age determination for standard muscovite, biotite and microcline samples by the argon method.*

Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 3, 28–32.

A report on inter-laboratory age determinations for 3 minerals from a muscovite-biotite-microcline-plagioclase pegmatite vein at Chernaya Salma, northern Karelia. The microcline has  $K\ 10.98 \pm 0.10\%$ ,  $A\ 0.930 \pm 0.053\ \text{mm}^3/\text{g}$ , giving an age of  $1478 \pm 68\ \text{m.y.}$ ; it has  $d_{201}\ 4.20$ , and is a maximum microcline. The muscovite has  $K\ 8.67 \pm 0.27\%$ ,  $A\ 0.991 \pm 0.044\ \text{mm}^3/\text{g}$ , giving  $1816 \pm 29\ \text{m.y.}$ ;  $d_{002}\ 9.99$ ,  $d_{060}\ 1.509$ ; and the biotite has  $K\ 7.78 \pm 0.31\%$ ,  $A\ 0.890 \pm 0.050\ \text{mm}^3/\text{g}$ , giving  $1814 \pm 26\ \text{m.y.}$ ;  $d_{002}\ 9.99$ ,  $d_{060}\ 1.548$ ;  $\gamma\ 1.658$ .

R. A. H.

KENDALL (B. R. F.). *Isotopic composition of potassium.*

Nature, 1960, **186**, 225–226.

A survey of the isotopic composition of potassium in natural samples, including two microclines giving anomalous K/A ages and two australites, showed no significant difference in either  $^{39}\text{K}/^{41}\text{K}$  ( $13.77 \pm 0.03$ ) or  $^{41}\text{K}/^{40}\text{K}$  ( $576 \pm 3$ ) relative to standard  $\text{KNO}_3$  prepared from Stassfurt sylvine. The assumption of constant  $^{40}\text{K}$  relative abundance is probably valid within close limits.

D. McK.

COMPSTON (W.) & JEFFERY (P. M.). *Anomalous 'common strontium' in granite.* Nature, 1959, **184**, 1792–1793.

Biotite and microcline from a Precambrian granite from Boya, Perth, Western Australia, have strontium enriched 8% above normal in  $^{87}\text{Sr}$ , while the 'total rock' strontium is normal. During metamorphism radiogenic strontium is redistributed, but the rock remains a closed system. The coarse grain of pegmatitic mica and feldspar favours retention of radiogenic strontium during metamorphism. 'Total rock' assay gives the age of the granite as 2430 m.y.; biotite gives 520 m.y. for the metamorphism.

D. McK.

COMPSTON (W.), JEFFERY (P. M.), & RILEY (G. H.). *Age of emplacement of granites.* Nature, 1960, **186**, 702–703, 2 figs.

Measurements of  $^{87}\text{Sr}/^{86}\text{Sr}$  and  $^{87}\text{Rb}/^{86}\text{Sr}$  on total rock samples (3) of a metamorphosed granite, a biotite pegmatite, and a muscovite pegmatite from Mundaring, Western Australia, yield consistent ages of 2700 m.y., and initial values of 0.0383 and 0.700 for the ratios radiogenic  $^{87}\text{Sr}/^{87}\text{Rb}$  and  $^{87}\text{Sr}/^{86}\text{Sr}$  respectively. Assuming initial uniformity in the isotopic composition of strontium, the measured ratios indicate that each total rock sample has remained a closed system, that the variability in measured Rb/Sr is due to initial inhomogeneity, and that the age determined is age of emplacement. Pegmatitic muscovite and muscovite formed in saussuritization of plagioclase in the granite also yield ages of 2700 m.y., whereas microcline and biotite exhibit incomplete retention of radiogenic products and yield ages down to 650 m.y.

D. McK.

MARMO (V.). *On the potassium-argon ages of the granitic rocks.* Schweiz. Min. Petr. Mitt., 1960, **40**, 17–36, 2 figs.

The discrepancies between the K/A age of microcline and of mica in the same granitic rock are discussed. It is concluded that these discrepancies are due rather to actual age differences between the microcline and the mica than to the different abilities of feldspar and mica to retain argon.

M. W.

DAVIDSON (C. F.). *The geological time-scale.* Nature, 1959, **184**, 1310.

A time-scale with mid-Cambrian at 517 m.y. is constructed from 91 recently published age determinations, 66 of which are Russian. Argon loss is held to be unimportant from non-perthitic feldspars. U and Pb are regarded as largely epigenetic in kolm concretions and syngenetic in the alum shales.

D. McK.

DAVIDSON (C. F.). *The geological time-scale.* Nature, 1959, **184**, 1473.

Hitherto unpublished ages are quoted of 292 and 288 m.y.

for the Dartmoor granite by K/A assay on biotite (H. Faul) and of 288 m.y. for Hercynian pitchblende from Geevor, Cornwall, by full isotopic assay (A. G. Darnley). Extension of the Holmes B time-scale just beyond the Davidson scale [preceding abstract] is indicated.

D. McK.

WETHERILL (G. W.). *Age of the base of the Cambrian*. Nature, 1960, **187**, 34-35.

A discussion is given of the difficulties encountered both geologically and chemically in assessing the position and age of the base of the Cambrian. It is considered that geochronologists should not prematurely accept the figure  $600 \pm 20$  m.y. [M.A. 14-313]

M. J. Le B.

HOLMES (A.). [Reply to Wetherill (G. W.), Nature, 1960, **187**, 34-35]. Nature, 1960, **187**, 35-36.

Some of the difficulties described by Wetherill [preceding abstract] are overrated. The base of the Cambrian is a mental concept, yet to be defined on palaeontological and/or geochronological criteria.

M. J. Le B.

ANON. *The Proterozoic in the U.S.S.R.* Nature, 1960, **187**, 742.

Absolute age determinations suggest that the Rhiphaean System may be demarcated in age as 1,100-500 m.y. Further data of several authors are given.

M. J. Le B.

DAVIDSON (C. F.). *Age of the Cambrian System*. Nature, 1960, **187**, 1020-1021.

Several lines of evidence show that the brannerite from Crocker Well, South Australia, cannot safely be used as affording critical evidence on the age of the base of the Cambrian.

M. J. Le B.

FOLINSBEE (R. E.), BAADSGAARD (H.), & LIPSON (J.). *Potassium-argon time scale*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 3, 7-17, 4 figs.

Late Cretaceous sanidines from a dinosaur-bearing bentonite bed give an age of 66 m.y.; micas from the same horizon give 75 and 79 m.y. Upper Cretaceous volcanic bentonites give biotite ages of 68 and 82 m.y. A Cretaceous (Cenomanian) sanidine is 94 m.y. old, but Middle Albian biotites give ages of 114 to 119 m.y. Leakage of argon from sanidine is thus suggested. K/A ages for Cretaceous and Jurassic glauconites are variable, usually younger than equivalent biotite or sanidine ages. These and other results suggest older Cretaceous and Jurassic ages, a lengthening of the Devonian period, and older Ordovician ages than those of the Holmes A scale [M.A. 10-111] but no major revision of the Holmes scale seems to be indicated [M.A. 14-313].

R. A. H.

KULP (J. L.). *The geological time scale*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 3, 18-27, 1 fig.

New isotopic age determinations on rocks with reasonably well defined stratigraphical positions permit refinement of the time scale from the Cambrian to the Recent. Key-points in the scale are discussed with the aid of recently published K/A, Rb/Sr and U(Th)/Pb ages: there are thus 18 well-defined samples whose age measurements are probably reliable to at least 5%. A new time scale is presented. It parallels that of Holmes [M.A. 10-111] fairly closely down to the bottom of the Cretaceous but then shows an overall expansion of about 15%; the Jurassic, Permian, and Carboniferous periods have been roughly doubled in length and the Ordovician somewhat shortened.

R. A. H.

FAUL (HENRY). *Geologic time scale*. Bull. Geol. Soc. America, 1960, **71**, 637-644.

Sixteen localities with apparently well-established stratigraphical and isotopic ages are reviewed on the basis of their value in establishing an absolute time-scale. New analytical data and K/A ages are presented for 14 biotite samples from localities in Montana, Cornwall, Vosges, Tennessee, Maine, and Alabama.

A. L. A.

GILETTI (B. J.). *Rubidium-strontium ages of Lewisian rocks from North-west Scotland*. Nature, 1959, **184**, 1793-1794.

Under certain conditions Rb and Sr are not lost from feldspars during metamorphism. Two biotites and a feldspar from Laxfordian rocks and a feldspar from a Scourian pegmatite give average ages of  $1440 \pm 30$  m.y. for the Laxfordian metamorphism and  $2730 \pm 30$  m.y. for the Scourian metamorphism. The primary Lewisian is thus at least as old as 2730 m.y., and the Torridonian younger than 1440 m.y. [M.A. 13-503]

D. McK.

VINOGRADOV (A. P.), KOMLEV (L. V.), DANILEVICH (S. I.), SAVONENKO (V. G.), TUGARINOV (A. I.), & FILIPPOV (M. S.). *Absolute geochronology of the Ukrainian Precambrian*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 9, 116-132, 1 fig.

Critically selected results of age determinations for rocks of the Ukrainian shield are summarized and a scheme for the geochronological sub-division of the Ukrainian Precambrian is given. The report includes 103 determinations by the Pb-U-Th method and 160 by the K/A method. The chief masses of Precambrian Ukrainian granites were formed between 1500 m.y. and 2100 m.y. ago, with a pronounced culmination of magmatism in the 1900-2100 m.y. period. Nine magmatic complexes are distinguished. The age of gneisses in separate ancient blocks is not less than 3000 m.y.

R. A. H.

OLKANOV (A. A.) & GERLING (E. K.). *The Pre-Cambrian geochronology of the Baltic shield*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 9, 183–191, 1 fig.

A proposed division of the Precambrian of the Baltic shield is based on 480 mica K/A age determinations and several Rb/Sr and Pb determinations. Ten age groups of Precambrian rocks are distinguished, each including a granite-pegmatite and a metamorphic episode. The date of the first appearance of life on the earth suggests an increase in the age of the Archean-Proterozoic boundary.

R. A. H.

VCHINNIKOV (L. N.) & HARRIS (M. A.). *Absolute age of geological formations of the Urals and the pre-Urals*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 3, 33–45, 1 fig.

Stages of intrusive activity in the Urals correspond to definite orogenic phases. The Archean (2100–1900 m.y.), the Proterozoic (1150–1000 m.y.), the Lower Palaeozoic (600–440 m.y.), the Middle Palaeozoic (360–320 m.y.), and the Upper Palaeozoic (270–240 m.y.) are distinguished. Mesozoic volcanic formations are also recognised. The dependence of argon content on the potassium and water contents in hydrobiotites is discussed and the argon retention of feldspars is correlated with the degree of orthitization.

R. A. H.

MOORE (J. M., Jr.), HART (S. R.), BARNETT (C. C.), & HURLEY (P. M.). *Potassium-argon ages in northern Manitoba*. Bull. Geol. Soc. America, 1960, 71, 225–230, 2 figs.

Analytical data and K/A ages are reported for 10 samples of biotite from northern Manitoba. The eight samples from areas west and north of the Nelson River yielded ages ranging from 1640 to 1810 m.y., whereas two samples from southeast of the Nelson River yielded ages the one of 340, the other of 2190 and 2200 m.y. The results support the choice of the Nelson River as the boundary between the Churchill province on the northwest and the Superior province on the southeast.

A. L. A.

ISHER (N. H.). *Age determinations of northern Australian granites*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 9, 179–182.

K/A and Rb/Sr age determinations on micas from granites indicate ages of 1695–1320 m.y. Dating of uranium deposits in this region of the Northern Territory gives ages of 900–500 m.y., showing that the uranium emplacement is not directly connected with granite intrusion. R. A. H.

GIFFIN (C. E.) & KULP (J. L.). *Potassium-argon ages in the Precambrian basement of Colorado*. Bull. Geol. Soc. America, 1960, 71, 219–222, 2 figs.

$^{40}\text{A}/^{40}\text{K}$  and K values are reported for 23 mica samples from scattered localities in the Precambrian rocks of Colorado and adjacent Wyoming. Only very general sample locations are given. The average isotopic age for the samples in the vicinity of Pikes Peak is  $1015 \pm 40$  m.y.; other values range from 980 to 1540 m.y. A. L. A.

COBB (J. C.) & KULP (J. L.). *U–Pb age of the Chattanooga shale*. Bull. Geol. Soc. America, 1960, 71, 223–224.

Isotopic U and Pb values are reported for three samples from the uppermost Devonian Gassaway member of Chattanooga shale, Youngs Bend area, Tennessee. The error on the  $^{238}\text{U}/^{206}\text{Pb}$  ages from analytical procedures and the initial lead correction are sufficiently small that these ages may be correct.  $^{238}\text{U}/^{206}\text{Pb}$  ages reported are  $450 \pm 70$  m.y.,  $350 \pm 15$  m.y., and  $350 \pm 12$  m.y. These results, if correct, seem to set a firm minimum age of 350 m.y. for the Mississippian-Devonian boundary. A. L. A.

KULP (J. L.), LONG (L. E.), GIFFIN (C. E.), MILLS (A. A.), LAMBERT (R. St J.), GILETTI (B. J.), & WEBSTER (R. K.). *Potassium-argon and rubidium-strontium ages of some granites from Britain and Eire*. Nature, 1960, 185, 495–497.

The potassium-argon isotope dilution method applied to biotites gives ages of  $271 \pm 5$  m.y. for the Dartmoor granite,  $250 \pm 15$  m.y. for the Land's End granite,  $391 \pm 7$  m.y. for the Shap adamellite,  $386 \pm 8$  m.y. for the Creetown granite, and  $386 \pm 6$  m.y. for the Leinster granite (biotite and muscovite). The rubidium-strontium method (isotope dilution technique using  $^{87}\text{Rb}$  and  $^{84}\text{Sr}$  or  $^{86}\text{Sr}$  tracers) applied to biotites from the same specimens gives ages of  $277 \pm 5$  m.y. for Dartmoor,  $381 \pm 7$  m.y. for Shap, and  $365 \pm 11$  m.y. for Creetown. Both Hercynian granites may have been emplaced simultaneously; Dartmoor is post-Lower Westphalian and may be latest Stephanian or Permian. The Caledonian granites are contemporaneous; Shap is post-Ludlovian and pre-Carboniferous, Creetown is post-Upper Silurian, and Leinster is post-Ordovician and pre-Upper Devonian. Agreement between the results of the two methods is better than with the K/A ages of Mayne, Lambert, and York; some lengthening of Holmes B time-scale is indicated, though less than proposed earlier. [M.A. 14–313] D. McK.

GENTNER (W.) & KLEY (W.). *Argonbestimmungen an Kaliummineralien—V. Altersbestimmungen nach der Kalium-Argon-Methode an Mineralien und Gesteinen des Schwarzwaldes*. Geochim. Cosmochim. Acta, 1958, 14, 98–104, (English summary).

MEHNERT (K. R.). *Argonbestimmungen an Kalium-mineralien—VI. Die geologische Entwicklung des Schwarzwald-Grundgebirges anhand absoluter Altersbestimmungen nach der K-A-Methode.* Geochim. Cosmochim. Acta, 1958, **14**, 105–113, (English summary).

K/A age determinations are given for 14 Variscan [Hercynian] and pre-Variscan igneous and metamorphic rocks from the Black Forest, Germany. The regional granitization of the Black Forest basement is early Variscan, earlier than the oldest Variscan igneous intrusion. [M.A. 12-277, 439]

R. C.

FAIRBAIRN (H. W.), HURLEY (P. M.), PINSON (W. H., Jr.), & CORMIER (R. F.). *Age of the granitic rocks of Nova Scotia.* Bull. Geol. Soc. America, 1960, **71**, 399–414, 4 figs., 1 pl.

The ages of biotite, muscovite, and K-feldspar in granitic rocks from 27 localities in Nova Scotia, as determined by K/A and Sr/Rb methods, fall in the range 300 to 400 m.y. At two localities, where nearby intrusive contacts with upper Lower Devonian fossiliferous sedimentary rocks are established, the best estimate of the age of the intrusive rocks is  $365 \pm 20$  m.y. Biotite and K-feldspar in granite from Cape Breton Island, believed to intrude nearby Middle Cambrian sedimentary rocks, have an estimated age of  $500 \pm 20$  m.y. Radiation-damage ratios for zircon at nine localities where the age has been determined show one concordant result and eight which are lower than the K/A and Sr/Rb ages by 16 to 33 per cent. These results suggest that the Holmes B time scale requires extension of the early Palaeozoic limits.

A. L. A.

JÄGER (E.) & FAUL (H.). *Altersbestimmungen an einigen Schweizer Gesteinen und dem Granit von Baveno.* Schweiz. Min. Petr. Mitt., 1960, **40**, 10–12.

The age of the Verzasca gneiss (Tessin) is found to be Alpine (Miocene, 17–19 m.y.) and that of the Baveno granite (N. Italy) Hercynian (Permo-Carboniferous, 268–291 m.y.). For a granite of the Aar-massif, the age found (77 m.y.) is believed to be 'mixed' due to Alpine metamorphism and partial alteration of the biotite. Both K/A and Rb/Sr methods were used for the same samples. [See following abstract]

M. W.

JÄGER (EMILIE) & FAUL (HENRY). *Age measurements on some granites and gneisses from the Alps.* Bull. Geol. Soc. America, 1959, **70**, 1553–1558, 1 fig.

K/A and Rb/Sr age measurements were made on biotite, muscovite, and K-feldspar from granites and gneisses from the Aar massif in the Bernese Oberland, the Ticino gneiss of the Penninic nappes in the Verzasca Valley, and the Baveno granite of Lago Maggiore in northern Italy. Aar massif: Zentraler Aaregranit (Räterichsboden), 23 m.y. by K/A on biotite; Mittagfluhgranit (Tehingelbrücke), 75 and 78 m.y. by K/A on biotite, 77 m.y. by Rb/Sr on biotite. Ticino gneiss (Verzasca): Plattengneiss (Brione), 18 m.y. by K/A on biotite, 17 m.y. by Rb/Sr on biotite, 19 m.y. by K/A on muscovite; granitgneiss (Corippo); 18 m.y. by K/A on biotite. Baveno granite: Mont Orfano, 268 m.y. by K/A on biotite, 290 m.y. by Rb/Sr on biotite, 291 m.y. by Rb/Sr on K-feldspar; Baveno, 269 m.y. by K/A on biotite. The analytical data are included.

A. L. A.

MILLER (J. A.). *Potassium-argon ages of some rocks from the South Atlantic.* Nature, 1960, **187**, 1019–1020.

Eight biotites and one muscovite from quartz-mica schists of the South Orkney Islands gave ages from 199–177 m.y. (Upper Triassic to Lower Jurassic). Other evidence, but none mineralogical, suggests that the schists are pre-Carboniferous but suffered a later retrograde metamorphism.

M. J. Le B.

GOLDBERG (EDWARD D.) & PARKER (ROBERT H.). *Phosphatized wood from the Pacific sea floor.* Bull. Geol. Soc. America, 1960, **71**, 631–632, 1 fig.

A sample of wood dredged from a depth of 410 metres has been phosphatized in that portion that was above the sediment-water interface, whereas the buried portion was nearly free of phosphate. The phosphate material was identified as carbonate-fluorapatite by X-ray, and contained 13 p.p.m. U and 0.2 p.p.m. Th. A  $^{14}\text{C}$  age determination indicates an age of more than 28,000 years.

A. L. A.

EPSTEIN (SAMUEL) & SHARP (ROBERT P.). *Oxygen-isotope variations in the Malaspina and Saskatchewan glaciers.* Journ. Geol., 1959, **67**, 88–102.

Based on reconnaissance studies, the  $^{18}\text{O}/^{16}\text{O}$  values of ice samples from the upper Seward Basin of Malaspina glacier are larger than those of the ice of the surrounding high mountain slopes. The values for ice from Saskatchewan glacier show a decrease downstream along the centerline indicating that ice at successively lower points along the line originated at successively higher points in the source area. Within limits, differences in  $^{18}\text{O}/^{16}\text{O}$  values may be useful in distinguishing sedimentary layering in the ice.

R. E. W.

KAFER (T. A.). *Sulphur isotopic variations in nature.*  
 Part 1—The preparation of sulphur dioxide for mass spectrometer examination. New Zealand Journ. Sci. Techn., 1957, **38** (B), 849–857, 2 figs. Part 2—A quantitative study of the reduction of barium sulphate by graphite for recovery of sulphide-sulphur for sulphur isotopic measurements. Op. cit., 955–968, 4 figs. Part 3—A study of the combustion characteristics of silver sulphide and lead sulphide for sulphur isotopic measurements. Op. cit., 969–981, 3 figs.

W. A. W.

KURODA (P. K.). *Nuclear fission in the early history of the earth.* Nature, 1960, **187**, 36–38, 1 fig.

M. J. Le B.

SLAWSON (W. F.) & AUSTIN (C. F.). *Anomalous leads from a selected geological environment in west-central New Mexico.* Nature, 1960, **187**, 400–401, 2 figs.

The study of lead isotopes from galena over an area of 5000 sq. miles shows that the isotopic composition reflects the geological environment.

M. J. Le B.

## APPARATUS AND TECHNIQUES

### Separating techniques, microscopy, X-rays, &c.

FAUL (HENRY) & DAVIS (GORDON L.). *Mineral separation with asymmetric vibrators.* Amer. Min., 1959, **44**, 1076–1082, 5 figs.

Several devices using the principle of asymmetric vibration for mineral separation are described. Feeders and paramagnetic separators are examined. A mica separator is illustrated.

A. C. H.

HORSFALL (F.) & JOWETT (A.). *Automatic decantation for routine sub-sieve sizing.* Journ. Sci. Instruments, 1960, **37**, 120–122.

Decantation of the supernatant suspension after a given sedimentation time, and redispersion of the residue, are repeated automatically according to a pre-set time schedule controlled electronically. Repetition of this process may be continued without attention until the desired proportion of undersize particles has been poured off. The instrument as described only permits sedimentation times up to 1 hour; modification to provide longer times is possible.

J.M.H.

FISHER (D. JEROME). *A new universal-type microscope.* Zeits. Krist., 1960, **113**, 77–93, 8 figs.

A synchronous-polar microscope has its tube mounted horizontally making it possible to suspend a crystal so that it extends vertically down into an immersion oil. The crystal is mounted on a standard goniometer head and thus may be orientated optically before proceeding with X-ray work, or vice versa. It is possible to get highly accurate values for the indicatrix orientation in relation to the reciprocal axes; the instrument may also serve as an accurate single-circle reflection goniometer.

R. A. H.

VINCENT (H. C. G.). *An improved orientation stage for microscopic optical crystallography.* Nature, 1958, **181**, 693.

CAMPBELL (W. J.), LEON (M.), & THATCHER (J. W.). *Solution techniques in fluorescence X-ray spectrography.* U.S. Bur. Mines, Rept. Invest., 1959, no. 5497.

Solution in dilute HNO<sub>3</sub> is preferable. The determinations of Mn and Fe in low grade Mn ore, Fe in low grade Cu ore, and Ca in wolframite are discussed.

R. A. H.

VAN NIEKERK (J. N.) & DE WET (J. F.). *Trace analysis by X-ray fluorescence using ion exchange resins.* Nature, 1960, **186**, 380–381, 3 figs.

Several trace elements in concentrations of a few p.p.m. can be estimated simultaneously without separation after collection on an ion exchange resin. Equilibrium is rapidly attainable with solid or liquid anionic and cationic resins. Internal standards can be used to overcome interference by co-adsorbed elements.

D. McK.

GADE (M.) & LUFT (K. F.). *Über ultrarotspektroskopische Quarzbestimmung in Grubenstäuben.* Naturw., 1959, **46**, 315–316.

Quartz may be detected and determined in samples of powdered coal or mineral ores by its absorption bands at 12.5  $\mu$ , 12.8  $\mu$ , and 14.4  $\mu$ . The background interference may be reduced by heating the sample to 700°C before infra-red examination. The absolute error is approx.  $\pm 1\%$ .

R. A. H.

WETZEL (W.). *Das lumineszenzmikroskopische Verhalten von Sedimenten*. Neues Jahrb. Geol. Paläont., Abhandl., 1959, **107**, 261–277, 15 figs., 2 pls., 1 colour pl.

Directions are given for the microscopic study of sediments under ultraviolet illumination. Luminescence of sediments may be due to various materials: organic substance retaining its original form, disaggregated organic material, bitumen, sedimentary phosphate, and abnormal constituents.

A. P.

HIRANO (S.) & SASUGA (H.). *Rational analysis of magnetite, pyrite and chalcopyrite in sulphide ores with a Geiger-counter X-ray diffractometer*. Japan Analyst, 1959, **8**, 495–500.

The method is satisfactory, but reproducibility decreases with increase in grain size. For chalcopyrite pulverization to <1 micron is required.

R. A. H.

MITCHELL (W. A.). *A method for quantitative mineralogical analysis by X-ray powder diffraction*. Min. Mag., 1960, **32**, 492–499, 2 figs.

In order to overcome absorption difficulties, specimens of mineral mixtures for quantitative analysis are diluted with about 66% by weight of gum arabic, and thoroughly mixed and ground with an internal standard (KCl, corundum, aluminium, etc.). Line intensities are measured by microphotometer on powder photographs taken with  $\text{CoK}_\alpha$  radiation, and percentages of unknowns are determined by reference to a universal intensity scale which takes the value of the 200 reflection of potassium chloride as 1000. Values of the stronger lines of a number of minerals are given, and within individual patterns these are consistent also with published data obtained by counter diffractometry.

J. Z.

LESSMAN (H.-D.). *Präzisionsverfahren mit Zählrohrgoniometer zur vollständigen Orientierung von Einkristallen*. Zeits. Krist., 1959, **111**, 94–116, 9 figs.

A rotation procedure is presented for the determination of the crystallographic orientation of any face of a single crystal.

R. A. H.

BAMBAUER (H. U.). *Direkte Bestimmung der Auslöschungsschiefe nach (h0l) verzwillingter monokliner Kristalle von allgemeiner Schnittlage, dargestellt an Pyroxenen und Amphibolen*. Zeits. Krist., 1959, **111**, 421–434, 4 figs.

A simple and rapid method is described by which twins on (h0l) in monoclinic crystals in sections not parallel to (010) can be oriented so that direct measurements of the extinction angle on (010) becomes possible. The scope of the method is discussed with regard to the determination of monoclinic pyroxenes and amphiboles twinned on (100).

R. A. H.

EBERT (F.). *Graphische Auswertung von Debye-Scherrer Diagrammen rhomboëdrischer Symmetrie*. Zeit. Krist., 1958, **111**, 15–23, 3 figs.

A procedure is described to index rhombohedral Debye-Scherrer diagrams. In contrast to the method of Hull [M.A. 1–186] it uses only systems of straight lines which cross each other and connect equidistant points on two parallel lines. A graphical evaluation is illustrated with hematite as an example.

R. A. H.

WOLFE (C. W.). *Polarizing adapters for the Wolfe goniometer*. Amer. Min., 1959, **44**, 182–184, 2 figs.

The modification of a Wolfe goniometer for use with polarized light is described. The procedure using polarized light to obtain the optical orientation of a synthetic corundum boule is outlined.

A. C. H.

PERDOK (W. G.) & BOOM (G.). *Improved eye-piece graticule for measuring X-ray powder diffraction patterns*. Journ. Sci. Instruments, 1960, **37**, 134–135.

A photographically prepared graticule is described which facilitates accurate measurement of the spacings of strongly curved high-angle lines in a Debye-Scherrer powder diffraction pattern.

J. M. H.

GATINEAU (L.). *Méthode graphique de détermination des paramètres dans les systèmes quadratique et hexagonal*. Bull. Soc. franç. Min. Crist., 1960, **83**, 146–147, 3 figs.

R. A. H.

### Chemical : gravimetric, volumetric, &c.

JEFFERY (P. G.) & WILSON (A. D.). *A combined gravimetric and photometric procedure for determining silica in silicate rocks and minerals*. Analyst, 1960, **85**, 478–486, 3 figs.

A method is described in which the bulk of the Si is recovered by a single evaporation with HCl followed by HF volatilization; the small amount (2 to 8 mg) remaining in the filtrate is determined photometrically by a molybdenum-blue method at 650 m $\mu$ . Fe, Ti, and P do not interfere provided that the concentrations of these elements in the original rock or mineral do not exceed 20%  $\text{Fe}_2\text{O}_3$ , 8%  $\text{TiO}_2$ , and 10%  $\text{P}_2\text{O}_5$ ; modified procedures are, however, described for the removal of Fe and Ti from solution by cupferron extraction or by alkaline fusion. Values obtained for G-1 and W-1 were 72.60, 72.66, and 52.63–52.67%  $\text{SiO}_2$  respectively. [M.A. 14–87, 237, 317]

R. A. H.

LOUVRIER (J.) & VOINOVITCH (I. A.). *[Volumetric determination of silica]*. Industr. Céram., 1959, 243–247. Anal. Abstr., 1960, **7**, abstr. 2661.

Si is quantitatively precipitated as  $K_2SiF_6$ ; HF is then generated by hydrolysis and titrated with NaOH. The method is rapid, adaptable to the use of an automatic titrator, and obviates initial separations. [M.A. 13-575]

R. A. H.

BAROVSKIĬ (F. G.). [Direct determination of aluminium in iron ores after a simultaneous separation of iron and titanium. Ukr. Khim. Zhur., 1959, 25, 245-248.] Anal. Abstr., 1960, 7, abstr. 3254.

Fe and Ti are separated from Al by the chloroform extraction of their compounds with *N*-benzoyl-*N*-phenyl-droxyamine.

R. A. H.

APIRO (L.). Design of Teflon vessel for decomposition of rock samples. Chemist Analyst, 1959, 48, 46.

A Teflon vessel is described which has a close-fitting lid, prevent the evaporation of HF during digestion, and which can be immersed in steam. After treatment overnight the process is completed by heating for about one hour to evaporate HF.

R. A. H.

BOOKS (R. R.). Dissolution of silicate rocks. Nature, 1960, 185, 837-8.

Teflon' is recommended as a cheaper alternative to platinum for apparatus in which large rock samples are to be dissolved in  $HF/H_2SO_4$  or  $HF/HClO_4$ . A dissolution technique is described.

D. McK.

BŢCAN (J.). [Determination of manganese oxides of various valencies. Hutn. Listy, 1959, 14, 1084-1086.] Anal. Abstr., 1960, 7, abstr. 3244.

Chemical procedures are described for the determination of  $MnO$ ,  $MnO_2$ ,  $Mn_2O_3$ , and  $Mn_3O_4$  in the same sample.

R. A. H.

LAIS (G.) & CURIEN (H.). Mesure de la teneur en bore-10 des minéraux. Geochim. Cosmochim. Acta, 1959, 17, 108-112, 2 figs.

A radiochemical method for the determination of  $^{10}B$  in minerals is based on the preferential absorption properties of thermal neutrons by this isotope: it has a precision of approx. 2% and is simple and rapid. Assuming that the ratio  $^{10}B/^{11}B$  is constant, this method can be used for the determination of boron. For borosilicates it has the advantage of not requiring the tedious extraction process necessary to eliminate Si.

R. A. H.

RLERA (M. LUCCO). [Determination of zirconium in rocks and quartz sands rich in iron. Ric. Sci., 1959, 29, 1465-1471.] Anal. Abstr., 1960, 7, abstr. 1701.

The greater part of the Fe is eliminated by distillation in a stream of Cl in the presence of graphite at approx. 350°C. A second distillation at 650°C permits the quantitative separation of Zr as  $ZrCl_4$ .

R. A. H.

PETCOV (R.) & RĂDUCAN (G.). [Determination of zirconium in alluvial sands. Rev. Chim., Bucharest, 1958, 9, 459.] Anal. Abstr., 1959, 6, abstr. 2096.

A gravimetric method makes use of Zr mandelate, and a colorimetric method uses alizarin red S. Separation of other elements is not necessary.

R. A. H.

MAISTERRA (J.H.). [Three different methods of determining copper in chalcopyrite concentrates. Chim. Anal., 1959, 41, 186-188.] Anal. Abstr., 1960, 7, abstr. 378.

Rapid electrolytic, absorptiometric, and volumetric (titration with  $Na_2S_2O_3$  solution) procedures are described for determining Cu after roasting the sample at 600-700°C, treating with conc.  $HNO_3$ , diluting, boiling, and filtering. Each method has a coefficient of variation of approx. 0.4%.

R. A. H.

SURAK (J. G.), FISHER (D. J.), BURROS (C. L.), & BATE (L. C.). Apparatus for pyrohydrolytic determination of fluorides. Anal. Chem., 1960, 32, 117-119, 2 figs.

Details of the design, materials, and construction are given for a reaction chamber and condenser. The method is recommended for materials from which fluorides are difficult to separate by fluosilicic acid distillation.

D. A. M.

COREY (R. C.), MYERS (J. W.), SCHWARTZ (C. H.), GIBSON (F. H.), & COLBASSANI (P. J.). Occurrence and determination of germanium in coal ash from power plants. U.S. Bur. Mines, 1959, Bull. 575, 68 pp.

Methods of ashing samples, to avoid loss of Ge by volatilisation, are discussed. Results obtained in co-operative tests using spectrographic, gravimetric, and colorimetric methods are compared.

R. A. H.

TRUSOV (YU. P.). [Determination of various forms of iron in rocks. Zhur. Anal. Khim., 1959, 14, 139-140.] Anal. Abstr., 1959, 6, abstr. 4406.

Ferrous, ferric, and pyritic iron are determined in a single sample. FeO is determined with  $KMnO_4$  following an  $HF-H_2SO_4$  attack in a  $CO_2$  atmosphere;  $FeO+Fe_2O_3$  is determined by filtering off the pyrite, which is claimed not to be attacked by this treatment, adding  $NH_4SCN$ , and titrating with  $Hg_2(NO_3)_2$ . The pyrite is ignited at 800°C, fused with  $K_2S_2O_7$ , dissolved in dilute  $H_2SO_4$ , and  $Fe^{3+}$  titrated with  $Hg_2(NO_3)_2$ .

R. A. H.

MURTHY (A. R. VASUDEVA) & SHARADA (K.). *Determination of sulphide sulphur in minerals*. Analyst, 1960, **85**, 299-300.

A previously described method [M.A. 14-84] could not be applied to the analysis of pyrite and chalcopyrite as the reaction was too slow. It can be hastened to completion, however, by using a concentrated solution of HI, with the addition of a pellet of mercury, and gentle heating.

R. A. H.

IONESCU (M.), DEMETRESCU (A.), & MITRAN (E.). [*Application of ion-exchange resin to the Lunge method for the determination of sulphur in ores*. Rev. Minelor, Bucharest, 1958, **9**, 473-475.] Anal. Abstr., 1960, **7**, abstr. 955.

A cation-exchange resin is used to remove heavy metal ions in the Lunge method for the determination of S as  $\text{SO}_4^{2-}$ , thus avoiding the lengthy double precipitation of heavy metals with ammonia. An accuracy of within 0.2% is reported.

R. A. H.

YALMAN (R. G.), BRUEGEMANN (W.), BAKER (P. T.), & GARN (S. M.). *Volumetric determination of calcium in presence of phosphate*. Anal. Chem., 1959, **31**, 1230-1233.

An indirect titration method using EDTA is described for the determination of Ca in bone and phosphate rock; small amounts of Mg and Fe do not interfere. For a phosphate rock standard with 44.06% CaO the average of four determinations gave  $44.17 \pm 0.04$  and  $44.10 \pm 0.02\%$  CaO using two variations in technique.

R. A. H.

RILEY (J. P.). *The use of continuous extraction for the removal of interfering elements in the determination of calcium and magnesium*. Anal. Chim. Acta, 1959, **21**, 317-323.

Solvent extraction with a continuous extractor has been used to separate Al, Be, Bi, Cd, Ce, Cr, Co, Cu, Ga, In, Fe, Pb, Hg, Mo, Tl, Th, Sn, Ti, W, U, V, Zn, and Zr from Ca and Mg in solutions of silicates before titration of Ca and Mg with EDTA [M.A. 14-87]. Mn is precipitated by boiling the extracted solution with sodium chlorite.

R. A. H.

LEWIS (L. L.) & MELNICK (L. M.). *Determination of calcium and magnesium with (ethylenedinitrilo) tetraacetic acid. Studies in accuracy*. Anal. Chem., 1960, **32**, 38-42, 1 fig.

Procedures of improved accuracy were developed based on empirically established stoichiometric titration conditions.

D. A. M.

TINKER (P. B. H.). *The rapid determination of exchangeable calcium and magnesium in highly leached soils*. Analyst, 1959, **84**, 743-745.

The soil extract in neutral N ammonium acetate titrated with EDTA using acid alizarin black SN as indicator for the determination of Ca.

R. A. H.

SODD (V. J.), GOLDIN (ABRAHAM S.), & VELTEN (R. J.). *Determination of radioactivity in saline waters*. Anal. Chem., 1960, **32**, 25-26.

The radioactive content of sea water is determined by screening procedure employing various precipitation techniques. By precipitation of basic sulphide, followed by carbonate and caesium precipitation steps, most isotopes of interest in sea water can be separated.

D. A. M.

BLACKIE (M. S.) & GOLD (V.). *Magnetometric titration: a new method of chemical analysis*. Nature, 1959, **184**, 1 fig.

C. H. K.

### Flame-photometric, spectrophotometric, colorimetric

FORNASERI (M.) & GRANDI (L.). *Flame photometric determination of strontium in silicates. Strontium content in the G-1 and the diabase W-1*. Geochim. Cosmochim. Acta, 1960, **19**, 218-221.

A method is described for the determination of Sr in silicates by flame photometry, using the standard addition technique. Background emission is taken into account and, if necessary, a high concentration of Ca is added to compensate for the depressing effect of Al. Values for G-1 and W-1 were 258 and 151 p.p.m. respectively.

R. A. H.

GUNDLACH (H.). *Beitrag zur flammenphotometrischen strontiumbestimmung in strontiumarmen Mineralen*. Zeits. anal. Chem., 1959, **171**, 9-22, 6 figs.

Sr is determined in 0.9% HCl solution at 460.7 and 460.8 mμ, the difference giving the Sr concentration.

R. A. H.

DEBRAS (J.) & VOINOVITCH (I. A.). [*Investigation of the possibility of the determination of strontium by flame spectrophotometry*. Bull. Soc. franç. Céram., 1959, **4**, 1-4.] Anal. Abstr., 1960, **7**, abstr. 2079.

[M.A. 14-317]

R. A. H.

WILLIAMS (C. H.). *The use of lanthanum chloride to prevent interferences in the flame photometric determination of exchangeable calcium in soils*. Anal. Chim. Acta, 1960, **22**, 163-171, 2 figs.

Provided the La:Al ratio is at least 12.5:1 by weight, interference from Al can be prevented.

R. A. H.

DEAN (J. A.). *Flame-photometric methods in metallurgical analysis*. Analyst, 1960, **85**, 621-629.

review of flame photometric analytical methods applicable to the determination of Na, K, Li, Rb, Cs, Al, B, Be, Ca, Cr, Co, Cu, Ga, In, Fe, Pb, Mg, Mn, Ni, Zn, Ag, noble metals, and the rare-earths.

R. A. H.

EURÉUX (M.) & CORNIL (J.). [*Spectrometric determination of silica in rocks, soil, plants and water*. Industr. Chim. Belge, 1959, **24**, 634-640.] Anal. Abstr., 1960, **7**, abstr. 1695.

Alkaline orthosilicates prepared at a  $\text{pH} > 10.9$ , when added to an acid molybdate solution at  $\text{pH} 1$  having a ratio  $\text{H}^+$  to  $\text{MoO}_4^{2-}$  between 1.5 and 2, form a stable  $\alpha$ -decamolybdosilicate. Molybdophosphate is extracted quantitatively with butanol- $\text{CHCl}_3$  and the molybdosilicate extracted with butanol. The method has been used directly for minerals low in  $\text{SiO}_2$ , and in silicate analysis to determine  $\text{SiO}_2$  in the washings after only one evaporation to dryness in a gravimetric determination. [M.A.15-6]

R. A. H.

UL (J.) & POVER (W. F. R.). *Colorimetric determination of silicon in the presence of phosphorus*. Anal. Chim. Acta, 1960, **22**, 185-189.

The method involves the selective extraction of phosphomolybdate with ethyl acetate and determination of the aqueous phase after reduction to molybdenum blue.

R. A. H.

BERSSON (L. H.). *Studies in the determination of silica. II. Separation of molybdophosphate from  $\alpha$ -molybdosilicate*. Acta Chem. Scandinavica, 1959, **13**, 1743-1752.

[M.A. 14-87]

R. A. H.

ERNER (H.). *Serienbestimmung von Bor in Sedimentgesteinen*. Zeits. anal. Chem., 1959, **168**, 266-268, 1 fig.

The samples are fused with  $\text{Na}_2\text{CO}_3$ , extracted with  $\text{SO}_4$ , distilled in a methanol- $\text{H}_2\text{SO}_4$  mixture, and the distillate evaporated to dryness. Dianthrime solution and trace of solid hydrazine sulphate are added, the solution heated at  $70^\circ$  for five hours, and the extinction determined photometrically. For sediments with 0.025%  $\text{B}_2\text{O}_3$  the accuracy is approx.  $\pm 10\%$ .

R. A. H.

MPBELL (ROBERT H.) & MELLON (M. G.). *An indirect absorptiometric method for the determination of boron*. Anal. Chem., 1960, **32**, 50-54, 4 figs.

The proposed method for the determination of boron at concentrations between 0.1 and 2.5 mg. per 50 ml is based on the removal of fluoride ion from molybdate-fluoride

complex or complexes with subsequent reduction of the molybdate to form molybdenum blue. Variables were investigated and a recommended general procedure is given.

D. A. M.

THOMPSON (C. E.) & NAKAGAWA (H. M.). *Spectrophotometric determination of traces of lead in igneous rocks*. Bull. U.S. Geol. Survey, 1960, **1084-F**, 151-164, 6 figs.

The method, with a sensitivity of 1 p.p.m., overcomes the inadequacy of existing dithizone methods for the determination of Pb in mafic igneous rocks that contain relatively large amounts of iron, zinc, and certain alkaline earths. Interference from these elements is avoided without the use of special equipment or of time-consuming separation techniques.

K. S.

FUKASAWA (T.), TAKABAYASHI (Y.), & HIRANO (S.). [*Photometric determination of small amounts of vanadium in various materials by the sodium diphenylaminesulphonate method*. Japan Analyst, 1959, **8**, 292-298.] Anal. Abstr., 1960, **7**, abstr. 1715.

This method has been applied to the analysis of ilmenite and other iron ores.

R. A. H.

FRÖLICH (F.). *Bestimmung kleiner Chromgehalte in Mineralen und Gesteinen mit Diphenylcarbazid*. Zeits. anal. Chem., 1959, **170**, 383-387, 1 fig.

Following fusion with sodium peroxide in an alumina crucible the melt is dissolved, Fe is removed by a cation exchange column, and Cr is determined colorimetrically as the sym.-diphenyl-carbazide complex at 540 m $\mu$ . For approx. 100  $\mu\text{g}$  Cr in minerals and rocks the relative error is  $\pm 2\%$ .

R. A. H.

EMI (K.), HAYASHI (T.), & TAKEDA (H.). [*Analytical studies on fluoride. IV. Determination of small amounts of fluorine in rocks*. Journ. Chem. Soc. Japan, Pure Chem. Sect., 1959, **80**, 731-735.] Anal. Abstr., 1960, **7**, abstr. 2219.

Following  $\text{ZnO-Na}_2\text{CO}_3$  fusion and extraction of F with sodium aluminate solution, HF is distilled off, collected in 0.1 N NaOH and determined colorimetrically with arsenazo.

[M.A. 13-324, 574]

R. A. H.

SHAPIRO (L.). *Rapid photometric determination of low-level magnesium in rocks*. Chemist Analyst, 1959, **48**, 73-74.

A method for determining from 0.01 to 2% of MgO in rocks containing up to several hundred times as much CaO uses thiazole yellow as the colour-forming agent, interfering elements being complexed with cyanide-triethanolamine.

R. A. H.

KONONENKO (L. I.) & POLUÉKTOV (N. S.). [*Colorimetric determination of zirconium in ores containing phosphates.* Zavod. Lab., 1959, **25**, 1050-1053.] Anal. Abstr., 1960, **7**, abstr. 2131.

This method uses alizarin red and is applicable in the range 0.01 to 2%  $ZrO_2$ . R. A. H.

OGATA (H.) & HOROI (K.). [*The simultaneous determination of calcium and magnesium. II. Colorimetric determination of traces of magnesium with Xylidyl blue II.* Japan Analyst, 1959, **8**, 21-25.] Anal. Abstr., 1960, **7**, abstr. 34.

R. A. H.

DEBRAS (J.), DEBRAS (A.), & VOINOVITCH (I. A.). [*Colorimetric determination of titanium dioxide in silicates.* Ind. Céram., 1959, 117-119.] Anal. Abstr., 1960, **7**, abstr. 935.

The  $H_2O_2$  and chromotropic acid methods are compared. The former method is inaccurate for <0.2%  $TiO_2$ , but for these low concentrations the measurement of the extinction of the chromotropic acid complex at 470 m $\mu$  and pH 2.6 is rapid, accurate, and sensitive. R. A. H.

VOSKRESENSKAYA (N. T.). [*Colorimetric determination of thallium in minerals and ores with Brilliant green.* Zavod. Lab., 1958, **24**, 395-398.] Anal. Abstr., 1959, **6**, abstr. 493.

The mineral is dissolved in HF and after treatment with HBr the Tl is separated from interfering elements by shaking the solution with ether. R. A. H.

GRIMALDI (F. S.). *Determination of niobium in the parts per million range in rocks.* Anal. Chem., 1960, **32**, 119-121.

A modified niobium thiocyanate spectrophotometric procedure relatively insensitive to titanium interference is presented. Elements such as tungsten, molybdenum, vanadium, and rhenium, which seriously interfere in the spectrophotometric determination of niobium, are separated by simple sodium hydroxide fusion and leach; iron and magnesium are used as carriers for the niobium. Tolerance limits are given for 28 elements in the spectrophotometric method. Specific application is made to the determination of niobium in the parts per million range in rocks. The granite G-1 contains 0.0022% niobium and the diabase W-1 0.00096% niobium. D. A. M.

SMYSHLAIEV (S. I.). [*Field method for the determination of titanium in rocks and ores.* Razveda i Okhrana Nedr, 1959, 48-49.] Anal. Abstr., 1960, **7**, abstr. 1318.

A rapid procedure is developed based on the decom-

position of silicates with  $NH_4F$ , ignition with oxalic acid and visual colorimetry of the peroxide complex of Ti.

R. A. H.

### Spectrographic

SHAW (D. M.), WICKREMASINGHE (O. C.), & WEBER (J. N.). *Spectrochemical determination of lithium, sodium, potassium and rubidium in rocks and minerals using the Stallwood jet.* Anal. Chim. Acta, 1960, **22**, 398-400.

A d.c. spectrographic method using the Stallwood jet. Samples are mixed with graphite and  $Cs_2CO_3$  in the ratio 2:1:1, Cs being the internal standard. For rock G-1 (U.S. Geol. Survey) values obtained were Li 26 p.p.m., Rb 28 p.p.m.,  $Na_2O$  3.27%,  $K_2O$  7.4%, and for W-1, Li 12 p.p.m., Rb 24 p.p.m. R. A. H.

SHEININA (G. A.) & KLER (M. M.). [*Spectrographic determination of rubidium and caesium in rocks and minerals by the method of additions.* Fiz. Sb. L'vovsk. Univ. 1958, **4**, 115-120.] Anal. Abstr., 1960, **7**, abstr. 1265.

The spectra are excited in an air-acetylene flame following decomposition with an  $HF-H_2SO_4$  mixture and the addition of Na, K, and Ca in sufficient amounts (determined by preliminary approximate analysis) to give reproducible results. R. A. H.

RUSANOV (A. K.), KHITROV (V. G.), & BATOVA (N. T.). [*Low-temperature carbon arc as source for exciting the spectra of rubidium, caesium, thallium and indium in the spectrographic analysis of silicates.* Zhur. Anal. Khim. 1959, **14**, 534-541.] Anal. Abstr., 1960, **7**, abstr. 2622.

These elements are determined in the presence of excess K, using a 5 amp current and a 2 minute burn. The mean probable error is  $\pm 11\%$ . R. A. H.

HELD (S.). *Spectrochemical determination of La and Sc in standard granite G.1 by the method of addition.* Spectrochim. Acta, 1960, **16**, 588-594, 1 fig.

The values reported are La  $80 \pm 16$  p.p.m. and Sc  $2 \pm 0.5$  p.p.m. G. D. N.

ARRAK (A.) & MITTELDORF (A. J.). *Accuracy in spectrochemical analysis.* Appl. Spectroscopy, 1959, **13**, 85-91, 6 figs.

New techniques suggested for improving accuracy include devices for reducing the effects of arc wandering and for ensuring reproducible electrode packing, and the use of the Stallwood jet and an enclosed arc chamber. R. A. H.

HURWITZ (J. K.). *Slopes of working curves in emission spectrometric analysis of certain silicates.* Appl. Spectroscopy, 1959, **13**, 113-116.

Large deviations from unity of the slopes of working curves for the spectrographic analysis of diopside, anorthite, and pseudowollastonite [STROCK, *ibid.*, 1953, **7**, 64, & 1954, 105] are explained by the relatively large errors inherent in the method or by self-absorption. R. A. H.

NISELEY (R. N.), FASSEL (V. A.), & LENTZ (C. F.). *Misidentifications in the arc spectra of the rare earths*. Spectrochim. Acta, 1960, **16**, 863-880.

289 errors in the listing of the emission lines of the rare-earth elements in the M.I.T. Wavelength Tables are reported. The errors lie either in misidentifications of the spectral lines or in discrepancies in the assigned intensities. G. D. N.

STROCK (R. R.) & AHRENS (L. H.). *The application of anion-exchange techniques to the spectrochemical detection of the noble metals in silicate rocks*. Spectrochim. Acta, 1960, **16**, 783-788.

A combined ion-exchange enrichment and spectrochemical procedure is used to detect Au, Pt, and the platinumoids except Os, in hortonolite dunite from the Preiskany Reef, Transvaal. After initial breakdown of 10 g of rock in a mixture of HF and aqua regia the dry residue is dissolved in 2NHCl and the solution absorbed on a column of Amberlite IR 400 resin. 0.25 NHNO<sub>3</sub> and 1% NH<sub>4</sub>OH are used for elution. Eluted fractions were collected by evaporation on a NaCl matrix and examined spectrographically. G. D. N.

TRASEVICH (N. I.) & SEMENENKO (K. A.). [*Spectrochemical determination of niobium in rocks*. Zhur. Anal. Khim., 1959, **14**, 705-709.] Anal. Abstr., 1960, **7**, abstr. 3210.

Nb is precipitated on silica gel and determined spectrographically. R. A. H.

PROLEV (V. V.) & VAÏNSHTEÏN (É. E.). [*Use of an impulse source for spectra excitation in the analysis of silicates*. Zhur. Anal. Khim., 1958, **13**, 627-634.] Anal. Abstr., 1960, **7**, abstr. 67.

A d.c. carbon arc is augmented by an impulse source, a condensed spark fed from a generator. In the method developed for the quantitative determination of Si, Ti, Al, Mg, Ca, Mn, Na, and K in silicate rocks there is no necessity for dilution with CuO or carbon. The mean error in each determination is 2 to 3%. [M.A. 13-572]

R. A. H.

VAÏNSHTEÏN (É. E.) & PAVLENKO (L. I.). [*Influence of the total composition of rocks on the results of the spectrographic determination of molybdenum in granitoids*. Fiz. Sb. L'vovsk. Univ., 1958, **4**, 120-123.] Anal. Abstr., 1960, **7**, abstr. 1340.

In the a.c. arc the rate of volatilization of Mo is strongly influenced by the amounts of Ca and Mg present in various granitic rocks. Ca and Mg when volatilized carry Mo with them; the effect is directly proportional to the concentration of Ca and Mg. R. A. H.

PLASTININ (V. V.). [*Spectrographic analysis of mica*. Zavod. Lab., 1959, **25**, 577-580.] Anal. Abstr., 1960, **7**, abstr. 1036.

An a.c. arc method for determining Fe, Si, Al, Mg, Mn, and Ca in mica, and a spark method, requiring fusion of the sample, for more accurate determinations of the major elements, are described. For the arc method 1% Co is used as internal standard and 0.03% V is added to give the arc temperature from measurements of relative line intensities. The line pairs used are listed. [M.A. 13-572] R. A. H.

SCHWANDER (H.). *Quantitative spektrochemische Bestimmung der Hauptkomponenten von Feldspäten und andern Silikaten*. Schweiz. Min. Petr. Mitt., 1960, **40**, 8-10.

Improvements of the Jaycox method [Journ. Opt. Soc. America, 1947, **37**, 162-165] are given. CuO is used as buffer and as internal standard for the determination of Si, Al, Fe, Ca, and Mg. Li<sub>2</sub>CO<sub>3</sub> is used as buffer for the determination of Na and K, SrCO<sub>3</sub> being admixed as internal standard. No standard deviations are presented. M. W.

BASTRON (HARRY), BARNETT (PAUL R.), & MURATA (K. J.). *Method for the quantitative spectrochemical analysis of rocks, minerals, ores, and other materials by a powder D-C arc technique*. Bull. U.S. Geol. Survey, 1960, **1084-G**, 165-182.

The method is especially valuable for the determination of constituents at low concentrations. Matrix effects between samples and standards are minimized by dilutions with a common base material. K. S.

### Thorium, various methods

LEVINE (HARRY) & GRIMALDI (FRANK S.). *Determination of thorium in the parts per million range in rocks*. Geochim. Cosmochim. Acta, 1958, **14**, 93-97.

A method for the determination of Th in the range 0.2 to 10 p.p.m. ThO<sub>2</sub> in rocks is briefly described. Th is extracted with mesityl oxide then purified by iodate precipitation and determined spectrophotometrically with thoron in mesotartaric acid medium. Results of Th determinations are given for standard granite G-1, standard diabase W-1, 2 basalts from Hualalai (1800 flow), Hawaii, and Snake River, Idaho, and 6 Laramide intrusives from the Front Range, Colorado. R. C.

KITAHARA (S.) & HARA (SHIN). *Determination of thorium in monazite ore by means of EDTA. I. Separation by precipitation with sodium iodate.* Rept. Sci. Res. Inst., Tokyo, 1957, **33**, 340-342.

HARA (SHIN) & KITAHARA (S.). *II. Titration of thorium, with catechol violet as indicator.* Ibid., 343-349.

Monazite ore is decomposed with  $\text{H}_2\text{SO}_4$ ; Zr and Ti are complexed with oxalic acid; and Th is precipitated with sodium iodate. The iodate is dissolved and Th is titrated with EDTA using catechol violet as indicator. R. A. H.

ATHAVALE (V. T.), OKE (K. P.), & TILLU (M. M.). *Rapid determination of thorium in ores. III. Determination of microgram amounts of thorium in ilmenite sands.* Anal. Chim. Acta, 1959, **21**, 528-531.

A previous method has been modified to determine 0.05% of monazite in ilmenite samples, using thorin as the colorimetric reagent with mercuric iodate as carrier.

R. A. H.

CHERNIKHOV (YU. A.), LUK'YANOV (V. F.), & KOZLOVA (A. B.). [Analytical chemistry of thorium. I. Complexometric determination of thorium in monazite concentrates. Zhur. Anal. Khim., 1959, **14**, 567-570.] Anal. Abstr., 1960, **7**, abstr. 2680.

Full details are given for the extraction of Th from monazite and for its determination with EDTA. The accuracy for 5 to 7% Th is 0.04% absolute. [M.A. **14-12**, 240, 319]

R. A. H.

NISHIMURA (S.). *Extraction of thorium and uranium from monazite (refining by solvent extraction).* Mem. Coll. Sci., Univ. Kyoto, 1959, ser. B, **26**, 173-191, 8 figs., 13 tables.

An economic manufacturing technique is described for the production of Th- and U-salts from monazite sand by solvent extraction.

M. S. J.

MORACHEVSKIĬ (YU. V.) & TSEKOVNITSKAYA (I. A.). [Gravimetric and photometric determination of thorium in uraninates by means of anthranilic acid. Zhur. Anal. Khim., 1959, **14**, 55-59.] Anal. Abstr., 1959, **6**, abstr. 3934.

Full details are given for the quantitative precipitation of Th, in the presence of U, Pb, and rare earths, from nitrate solution of pH 4.2 to 5.6, by anthranilic acid.

R. A. H.

BOUVIER (J. A. F.) & GUEST (R. J.). *The thoron colorimetric method for thorium determination: effect of some common ions, and methods for overcoming interference.* Rept. Dept. Mines & Tech. Surv., Mines Branch, Canada, 1958, 17 pp.

A comparison is made of ascorbic acid and hydroxy ammonium chloride for overcoming the interference of Fe and Ce. The second reducing agent is not affected by the presence of Mo; Ti causes low results for Th, and has a very low tolerance limit; by using mesotartaric acid as a masking agent about 5 mg of Zr could be tolerated in the final 25 ml aliquot used for colorimetric measurement.

R. A. H.

ZAĬKOVSKIĬ (F. V.). [Complexometric and photometric determination of thorium in minerals and ores. Zhur. Anal. Khim., 1959, **14**, 440-444.] Anal. Abstr., 1960, **7**, abstr. 2152.

R. A. H.

GERKHARDT (L. I.). [Extraction-photometric determination of thorium in natural materials. Zhur. Anal. Khim., 1959, **14**, 434-439.] Anal. Abstr., 1960, **7**, abstr. 2153.

With phenyleinchoninic acid Th forms a compound which is insoluble in water but soluble in alcohols. The solution of this compound in butanol is used to determine Th colorimetrically with arsenazo; ascorbic acid is added to complex Ti, Zr, and U which are not extracted.

R. A. H.

SURYANARAYANA (S. Y.) & RAO (BH. S. V. RAGHAVAN). *Separation of uranium and thorium.* Journ. Sci. Industr. Res. India, 1958, **17B**, 310-312.

A simple and direct ion-exchange method is described.

A. P. S.

LUK'YANOV (V. F.), SAVVIN (S. B.), & NIKOL'SKAYA (I. V.). [Photometric determination of thorium in zircon by means of the new reagent Arsenazo III. Zavod. Lab., 1959, **25**, 1155-1157.] Anal. Abstr., 1960, **7**, abstr. 3197.

R. A. H.

KORKISCH (J.) & ANTAL (P.). *Methode zur Anreicherung von Thorium aus salpetersaurer äthylalkoholischer Lösung an stark basischen Anionenaustauscher Dowex-I. Anwendung zur Bestimmung von Thorium in Silicatgesteinen.* Zeits. anal. Chem., 1959, **171**, 22-27.

Th is concentrated from a nitric acid-ethanol solution with Dowex-I strongly basic anion-exchange resin, and determined spectrophotometrically at 545 m $\mu$  with thoron.

R. A. H.

MARINKOVIĆ (M. D.). [Spectrochemical determination of thorium by d.c. arc. Bull. Inst. Nucl. Sci. 'Boris Kidrich', Belgrade, 1959, **9**, 215-217.] Anal. Abstr., 1960, **7**, abstr. 942.

Errors reducing the accuracy of spectrochemical analysis of Th in minerals are discussed. By using CuO as a buffer the background is reduced, leading to more accurate results at lower concentration. The precision is  $\approx 4\%$ .

R. A. H.

GUNTEN (H. R.), BUSER (W.), & HOUTERMANS (F. G.). *Determination of extreme Th/U ratios in minerals: a radiochemical method for determination of thorium*. Proc. 2nd U.N. Intern. Conf. Peaceful Uses Atomic Energy, 1958, **2**, 239-241, 3 figs.

A radiochemical method is described based on the measurement of the radioactivity of a decay product of

thorium,  $^{212}\text{Pb}$ , which is extracted by the dithizone method from the mineral in solution. The laborious separation of thorium from the rare earths is thereby avoided. Experimental details are given, together with results on pitchblende specimens from St. Joachimsthal [Jáchymov] and Shinkolobwe, Katanga.

A. G. D.

## BIBLIOGRAPHIES AND BOOK NOTICES

BOOKER (MARJORIE). *Data of rock analyses—II (Supplement)*. Geochim. Cosmochim. Acta, 1957, **11**, 138.

Bibliography and index of rock analyses in the African periodical and serial literature. [M.A. **14**-241] R. C.

BOOKER (MARJORIE). *Data of rock analyses—III. New Zealand periodical and serial literature*. Geochim. Cosmochim. Acta, 1957, **11**, 130-137.

Bibliography and index of rock analyses. R. C.

BOOKER (MARJORIE). *Data of rock analyses—IV. Icelandic periodical and serial literature*. Geochim. Cosmochim. Acta, 1959, **15**, 30-31.

Bibliography of rock analyses. R. C.

BOOKER (MARJORIE). *Data of rock analyses—V. Bibliography and index of rock analyses in the Australian periodical and serial literature*. Geochim. Cosmochim. Acta, 1959, **15**, 342-369.

R. C.

VRZŇÍK (B.) & HAVLE (J.). *Mineralogical and geological bibliography of Czechoslovakia for the year 1957*. Prague (Publ. Czechosl. Acad. Sci.), 1958, 180 pp. Price 12.20 Kčs.

The 23rd volume of references to Czechoslovak publications dealing with mineralogy, petrology, geochemistry, and geology and to publications by foreign authors on work concerning Czechoslovak territory or specimens. J. N.

ATTORI (H.) & NOZAWA (T.). *Chemical composition of granitic rocks in Japan*. Geol. Survey Japan, 1959, 217 pp. of tables, 2 maps (2 pp. English explanation).

ATES (ROBERT L.). *Geology of the industrial rocks and minerals*. New York (Harper & Brothers), 1960, 424 pp. Price \$10.00.

R. A. H.

LYTH (F. G. H.). *A geology for engineers*. 4th edition. London (Edward Arnold), 1960, 348 pp., 152 illus. Price. 30s.

R. A. H.

DUNNING (CHARLES H.) & PELOW (EDWARD H., Jr.). *Rock to riches. The story of Arizona mines and mining, past, present and future*. Phoenix, Arizona (Southwest Publishing Co.), 1959, viii + 406 pp. Price \$8.75.

Reviewed A.M. **45**-751 by E. Wm. Heinrich. A. C. H.

GILLSON (J. L.), editor. *Industrial minerals and rocks*. 3rd edition. New York (Amer. Inst. Mining, Metall., & Petrol. Engrs.), 1960, 934 pp., illustrd. Price \$12.00.

R. A. H.

HEJTMAN (S.) & KONTA (J.). *Horninotvorné minerály [Rock-forming minerals]*. 2nd edition. Czechoslovak Acad. Sci. Publ., 1959, 308 pp., 292 figs., 1 colour pl., (In Czech). Price 24.90 Kčs.

The book contains a general part on mineral optics and methods of research, and a special part which reviews the chemical, optical, and microscopical properties of the most important rock-forming minerals. This new edition contains descriptions of recently developed methods of study of feldspars. J. N.

HURLBUT (CORNELIUS S., Jr.). *Dana's manual of mineralogy*. 17th edition. New York (John Wiley & Sons), 1959, xi + 609 pp., 634 figs., 1 colour pl. Price \$11.50.

Reviewed A.M. **45**-750 by C. Wroe Wolfe. A. C. H.

HURLEY (P. M.). *How old is the earth?* London (Heinemann), 1960, 160 pp., 45 figs. Price 4s. 6d.

R. A. H.

KAŠPAR (J.), ŠMÍD (J.), & ECKSTEIN (J.). *Monokrystály [Single-crystals]*. Praha (Státní nakladat. techn. lit.), 1957, 216 pp., 146 figs., (Czech with Russian and English summaries).

The first part of the book gives the essentials of the theory of single-crystals and an introduction to crystal chemistry. The second part provides a summary of experience gained in Czechoslovakia and of the work published in foreign technical literature on the artificial preparation of single-crystals. J. N.

KOPECKÝ (L.) & VOLDÁN (J.). *Krystalisace tavených hornin* [Crystallization of rock-melts]. Geotechnica (Geol. Zentr. Inst.), 1959, **25**, 210 pp., 32 pls., (Czech, with English summary). Price 34.50 Kčs.

The book gives the results of co-operative studies by the Glass Research Institute, Hradec Králové, and the Geological Central Institute, Prague. It discusses the historical development of the glass industry, the requisite properties of the raw materials, and the technology of the processes. The authors review the fusibilities of the rocks concerned, the sequence of melting and the fusion temperatures of their minerals, recrystallization of the rock-melts, the new-formed minerals, structure of various rock-groups, and the qualitative and quantitative effects of the chemical composition of the original rocks. J. N.

KUKUK (PAUL). *Geologie, Mineralogie und Lagerstättenlehre*. 3rd edition. Berlin (Springer), 1960, xvi+354 pp. Price DM 28.50.

Reviewed A.M. 45-751 by E. Wm. Heinrich. A. C. H.

OFTEDAL (IVAR W.). *Steiner i farger*. Oslo (H. Aschehoug & Co.), 1960, iv+112 pp., 64 coloured pls. Price 19.50 Kr.

R. A. H.

ROBERTSON (R. H. S.). *Mineral use guide or Robertson's spider's webs*. London (Cleaver-Hume Press), 1960, 40 pp. (diagrams). Price 21s.

R. A. H.

SWINEFORD (ADA), editor. *Clays and clay minerals. Proceedings of the Seventh National Conference on Clays and Clay Minerals*. Oxford (Pergamon Press), 1960, 356 pp. Price 60s., \$8.50.

R. A. H.

WADE (F. A.) & MATTOX (R. B.). *Elements of crystallography and mineralogy*. With an Introduction by C. CRONEIS. New York (Harper & Bros.), 1960, xiv+333 pp. Price \$7.50, £3 0s. 0d.

R. A. H.

## CLAY MINERALS

### Methods : Structure

LYON (R. J. P.) & TUDDENHAM (W. M.). *Infra-red determination of the kaolin group minerals*. Nature, 1960, **185**, 835-6, 1 fig.

Kaolinite, halloysite, and dickite are distinguishable by the intensity ratio of infra-red absorption peaks at  $2.70\mu$  and  $2.75\mu$ . A modification of the kaolinite structure is proposed to explain the similarity of the absorption spectra of halloysite and dickite and their contrast with that of kaolinite. D. McK.

MOUM (J.) & ROSENQUIST (I. TH.). *Hydrogen (protium)-deuterium exchange in clays*. Geochim. Cosmochim. Acta, 1958, **14**, 250-252, 3 figs.

The relative mobility of H in clay minerals has been examined by experimental exchange reactions of  $D_2O$  with a postglacial illite clay from Åsrum, Norway. H of the clay has at least three different states, each with a distinctive exchange reaction rate. Adsorbed water is exchanged in seconds or minutes;  $H_3O^+$  water in weeks;  $OH^-$  water in years or centuries, even at elevated temperatures.

R. C.

DESHPANDE (K. B.) & MARSHALL (C. E.). *An interpretation of electrochemical measurements on a montmorillonite clay*. Journ. Phys. Chem., 1959, **63**, 1659-1662.

W. T. H.

BLACKMORE (A. V.) & WARKENTIN (B. P.). *Swelling of calcium-montmorillonite*. Nature, 1960, **186**, 823-824, 2 figs.

New data relating swelling pressure and [001] spacing show that any swelling in a calcium clay-water system is largely osmotic, is due to disorder, and is well described by the Gouy-Chapman model. D. McK.

MACKENZIE (ROBERT C.). *Density of water sorbed on montmorillonite*. Nature, 1958, **181**, 334.

Density measurements cannot yet give useful conclusion regarding interlayer water configuration because some water molecules may fit into the holes in the hexagonal network of the oxygen ions forming the surface of the individual mineral layers and also, at low water contents, the layers may not be flexible enough to fit closely around the water 'islands'. The errors in estimating the volume of sorbed water arising from these factors have not as yet been assessed. C. H. K.

SAWHNEY (B. L.). *Aluminium interlayers in clay minerals: montmorillonite and vermiculite: laboratory synthesis*. Nature, 1960, **187**, 261-262, 1 fig.

The introduction of aluminium interlayers in montmorillonite and vermiculite stabilized their structures so that when heated for 2 hours at  $300^\circ C$ , the  $14\text{\AA}$  spacing did not close to  $10\text{\AA}$ , even when heating followed potassium saturation. These interlayers also decreased the c.e.c. of these minerals. M. J. Le B.

TOUELL (R. F.). *Isomorphous replacement in the kaolin group of minerals*. Nature, 1958, **181**, 557-558, 1 fig.

Chamosite analyses can be represented in a triangular composition diagram based on  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$  and  $\text{RO}$  (the latter including all Fe calculated as ferrous). Actual specimens lie on the line joining  $\text{RO}$  with the kaolinite  $2\text{SiO}_2\cdot\text{Al}_2\text{O}_3$  plot. This series forms a basis for the classification of chamosites.

C. H. K.

NAKAHIRA (M.) & SUGIURA (S.). *A regular mixed-layer chlorite-vermiculite mineral*. Nature, 1960, **186**, 877-878, 1 fig.

High-temperature X-ray diffractometer studies of a mixed-layer  $29\cdot2\text{\AA}$  chlorite-vermiculite from an altered Tertiary mudstone in the Noto peninsula, Japan, show that at  $300^\circ\text{C}$  dehydration to  $23\cdot5\text{\AA}$  and  $26\text{\AA}$  phases occurs, and at  $500^\circ\text{C}$  to a single  $24\text{\AA}$  layer structure. Observation of some *hkl* reflexions indicates some regularity in the stacking of layers. On heating, *c*-axis contraction appears to be accompanied by *b*-axis expansion.

D. McK.

WALKER (G. F.). *Macroscopic swelling of vermiculite crystals in water*. Nature, 1960, **187**, 312-313, 1 fig.

The  $d_{001}$  spacing of vermiculite containing interlayered butylammonium ions increases suddenly from  $\approx 9\text{\AA}$  at high concentrations of butylammonium ions in the external solution to  $\approx 170\text{\AA}$  at a lower concentration. Further dilution results in continuous swelling to  $\approx 530\text{\AA}$ . [M.M. 18-598]

M. J. Le B.

AYLMORE (L. A. G.) & QUIRK (J. P.). *Domain or turbostratic structure of clays*. Nature, 1960, **187**, 1046-1048, 4 figs.

Diffuse double-layer formation is not of any great significance for the swelling of Ca-illites, though it may exist for crystals of Ca-clays in a suspension.

M. J. Le B.

### Properties

AMERS (M. A.) & THOMAS (H. C.). *Ion-exchange properties of kaolinite slurries*. Journ. Phys. Chem., 1960, **64**, 29-32, 4 figs.

Anion and cation exchange capacities confirm the previously postulated mode of flocculation in which positively charged edges stick to negatively charged faces.

W. T. H.

MERSON (W. W.). *Complexes of calcium-montmorillonite with polymers*. Nature, 1960, **186**, 573-574, 1 fig.

Complex formation with various polymers depresses the swelling of Ca-montmorillonite. Polymers can be displaced

with varying ease, the most stable complexes, such as that with polyvinyl alcohol, being hydrogen-bonded to surface oxygens of the sheet structure.

D. McK.

QUIRK (J. P.) & THENG (B. K. G.). *Effect of surface density of charge on the physical swelling of lithium-montmorillonite*. Nature, 1960, **187**, 967-968, 2 figs.

M. J. Le B.

ROLFE (B. N.), MILLER (R. F.), & MCQUEEN (I. S.). *Dispersion characteristics of montmorillonite, kaolinite, and illite clays in waters of varying quality, and their control with phosphate dispersants*. Prof. Paper U.S. Geol. Survey, 1960, **334-G**, 229-273.

The characteristics of the clay minerals are related to the control of canal seepage by artificial sedimentation. Montmorillonite shows the greatest colloidal yield and responds more to changes in chemical environment than does kaolinite or illite. Montmorillonite-type clay minerals are superior for the penetration and filling of small voids, whereas kaolinite and illite are suitable as mortaring agents in filling large openings.

K. S.

SLABAUGH (W. H.). *Adsorption characteristics of homoionic bentonites*. Journ. Phys. Chem., 1959, **63**, 436-438, 4 figs.

Hydration of Wyoming bentonite with various exchanged cations adsorbs water by a two-stage process.

W. T. H.

SLABAUGH (W. H.). *Heats of immersion of preheated homoionic clays*. Journ. Phys. Chem., 1959, **63**, 1333-1335, 2 figs.

The Wyoming bentonite and Na-substituted material had a heat of immersion of 11-12 cal/g regardless of pre-treatment. Ca- and H-substituted bentonite annealed in a vacuum for a day showed heats of immersion increasing to twice this value for annealing temperatures up to  $150^\circ\text{C}$  and decreasing at higher temperatures. Apparently annealing below  $150^\circ\text{C}$  removes all water from interlaminar Na ions but not from Ca ions.

W. T. H.

BROOKS (C. S.). *Free energies of immersion for clay minerals in water, ethanol and n-heptane*. Journ. Phys. Chem., 1960, **64**, 532-537, 5 figs.

Vapour desorption isotherms from API pyrophyllite, kaolinite, illite, and montmorillonite were measured for these vapours, and free energies of immersion were calculated from interfacial areas given by the same isotherm (based on a calculated nearly constant area per cation-exchange site of  $20 \times 10^{-8}$  me./cm<sup>2</sup>). Results in the range 200-350 ergs/cm<sup>2</sup> for water may be compared with 275 ergs/cm<sup>2</sup> for quartz [M.A. 15-46], an increase being attributed to greater energy around exchangeable cation sites.

W. T. H.

**Petrography : weathering : soils**

MITSUDA (T.). [On acid clays and cristobalite from Itoigawa]. Journ. Min. Soc. Japan, 1960, **4**, 335-362, 8 figs., 6 tables, 4 pls., (in Japanese).

X-ray powder patterns, d.t.a. curves, ign. loss, chemical constituents, base-exchange capacities, infra-red absorptions, and electron micrographs were examined for various acid clays from Itoigawa, Japan. Montmorillonite, cristobalite, and gelatinous silicic acid are the main constituents of the clays. Hydrated halloysite is found at the margin of the ore body, and an irregular mixed-layer mineral, consisting of kaolinite and montmorillonite layers, at a contact zone between the halloysite and the acid clays. Cristobalite decreases in amount in the zone marginal to the ore body, and is not found in the halloysite. It is concluded that montmorillonite is formed mainly by hydrothermal action and surface weathering. M. S. J.

YAMAMOTO (T.). *Rô-seki clays from Mitsuishi, Okayama Prefecture*. Journ. Min. Soc., Japan, 1959, **4**, 277-292, 5 figs., 8 pls., 7 tables, (in Japanese).

Results of X-ray investigation, thin-section observation, chemical analysis, and firing test for Rô-seki clays from Daiyama, Mitsuishi, are described. From X-ray powder diagrams, main constituent minerals of the clays are found to be diaspore, kaolinite, boehmite, pyrophyllite, sericite, and quartz. Parageneses of these minerals are established from the results of chemical analysis and X-ray data. Clays with high  $\text{SiO}_2$  and  $\text{Al}_2\text{O}_3$  content are found to be high in refractoriness, whereas those with chemical composition equivalent to that of the eutectic point of the  $\text{Al}_2\text{O}_3$ - $\text{SiO}_2$  system are low. [M.A. 14-246, 247] M. S. J.

SWINDALE (L. D.) & JACKSON (M. L.). *A mineralogical study of soil formation in four rhyolite-derived soils from New Zealand*. New Zealand Journ. Geol. Geophys., 1960, **3**, 141-183, 8 figs.

In four yellow-brown earth and podsolized yellow-brown earth soils derived from rhyolite, the mineralogical changes following on weathering and podsolization are described, and an explanation of the formation of the soils is offered. The minerals were found to vary in their powers of resistance to weathering in the order : oligoclase < sanidine < mica (muscovitic) = chlorite < expanding micas (vermiculite and montmorillonite) < kaolin < gibbsite. Rhyolitic glass was less stable than sanidine, and quartz was at least as stable as gibbsite. Evidence suggests that the order of resistance to podsolization was almost the reverse of the above order, but again quartz was very resistant. Secondary silica, as cristobalite, appeared to be the only mineral formed by podsolization. Brief mineralogical data are amplified by sketches of representative X-ray diffraction patterns obtained from the different soil fractions. W. A. W.

HAY (RICHARD L.). *Rate of clay formation and mineral alteration in a 4000-year-old volcanic ash soil on St. Vincent, B.W.I.* Amer. Journ. Sci., 1960, **258**, 354-368, 4 figs.

The surface of a large fan of 4000-year-old pyroclastic deposits is weathered to soil to a depth of 6 feet. The deposit was originally andesitic ash composed of anorthite, labradorite, hypersthene, augite, olivine, and glassy material. Vitric ash and lapilli are now halloysite.  $4\text{H}_2\text{O}$  and allophane, plus ferric oxides. Anorthite, hypersthene, and some of the augite and olivine crystals are now etched. Labradorite, hornblende, and magnetite are unaltered. Clay minerals were identified in this study by X-ray diffraction and d.t.a. H. W.

TAGGART (M. S., Jr.) & KAISER (A. D., Jr.). *Clay mineralogy of the Mississippi River deltaic sediments*. Bull. Geol. Soc. America, 1960, **71**, 521-530, 8 figs.

Four cores of Mississippi River deltaic sediments and samples of sediment from the Mississippi and Red rivers were studied by X-ray defraction methods. All the deltaic samples contained montmorillonite, illite, kaolinite, and chlorite, montmorillonite being the most abundant clay mineral in most, but much less abundant in some. High montmorillonite occurred both in samples from marine and from fresh-water facies. Samples of Red River sediment, characteristically reddish-brown, were predominantly low, samples of the gray Mississippi River sediment were high in montmorillonite; these differences in clay-mineral composition and in colour correlate substantially with the variations shown by samples of deltaic sediment. The results seem to support the hypotheses that clay minerals do not alter appreciably as a result of diagenesis in a marine environment and that clay-mineral composition of source sediments determines the clay-mineral content of marine sedimentary rocks. A. L. A.

GRIM (RALPH E.), KULBICKI (GEORGES), & CAROZZI (ALBERT V.). *Clay mineralogy of the sediments of the Great Salt Lake, Utah*. Bull. Geol. Soc. America, 1960, **71**, 515-520, 1 fig.

X-ray diffraction study of 120 samples indicates that the modern lake sediments and those sediments of post-Provo age immediately preceding the present Great Salt Lake have about the same clay-mineral composition. Both contain relatively poorly organized montmorillonite, generally well-organized illite, and kaolinite. Mixed-layer components and chlorite are generally absent, and there are no attapulgite-sepiolite clay minerals. The Lake Bonneville terraces have a somewhat different clay mineral composition; they contain a highly degraded chlorite and a very well-ordered montmorillonite. TH

reen clays of early Pleistocene age have a distinctive composition characterized by high illite and low montmorillonite with associated chlorite.

A. L. A.

ALLEN (V. T.) & JOHNS (W. D.). *Clays and clay minerals of New England and eastern Canada*. Bull. Geol. Soc. America, 1960, **71**, 75-86, 1 fig.

Clay minerals were collected from shales and clays of New England and eastern Canada ranging in age from Precambrian to Recent. Fifty-six samples were selected for detailed petrographic and X-ray study. K-clay minerals, or hydrous micas, and chlorite are the abundant minerals of the marine shales examined. Hydrous mica, chlorite, or vermiculite are the abundant minerals of the nonmarine, varved clays and of clays containing marine fossils of Quaternary age. Clay from glacial till also contains K-clay minerals and vermiculite. The source material had a greater influence on the clay-mineral composition than the environment in which deposition occurred. The clays and shales which contain abundant kaolinite were apparently deposited under nonmarine conditions.

A. L. A.

BENTOR (Y.). *Genetic classification of clays and shales in Israel*. Bull. Res. Council Israel, 1957, **6B**, 279-280.

General observations on the occurrence of marine, lagoonal, lacustrine, residual, and hydrothermal clays are reported.

D. H. Y.

BERNBERG (D.), BARTA (J.), & PRATT (B.). *Determination of quartz in local clays by means of X-ray diffraction*. Bull. Res. Council Israel, 1958, **6C**, 215-219, 1 fig., 3 tables.

Quartz in six sedimentary clays from Wadi Hatira and Wadi Ramon, Negev, Israel, ranged from 16 to 28%. In two flint clays it was absent. Good agreement between X-ray and chemical methods was obtained.

D. H. Y.

RAVIKOVITCH (S.), PINES (FANYA), & BEN-YAIR (M.). *Composition of colloids in the soils of Israel*. Ktavim, Rehovot [Records, Agric. Exp. Stn., Rehovot], 1958, **9**, 69-82, 5 tables.

The chemical and mineralogical composition of the colloid fraction from various soil types of Israel is reported. The Mediterranean leached soils are characterized by kaolinite, illite, hematite, quartz, and occasionally montmorillonite. In the soils of the semi-arid and arid regions montmorillonite is predominant, with palygorskite, illite, kaolinite, and quartz also present. In alluvial soils of sub-humid and semi-arid conditions montmorillonite is dominant.

D. H. Y.

AISENSTEIN (B.). *Some physical properties of loess soils in Israel*. Bull. Res. Council Israel, 1959, **8G**, 135-141, 2 figs., 3 tables.

Grain size and mineralogical analyses of several samples of loess are presented. A distinction between aeolian loess and reworked loess containing alluvial clay is believed possible on the basis of these data.

D. H. Y.

YAALON (D. H.). *Weathering reactions*. Journ. Chem. Educ., 1959, **36**, 73-76, 1 fig.

A summary of the mechanism and kinetics of weathering, and of the reactions of feldspar alteration to kaolinite, mica, or montmorillonite.

M. J. O.

### Various

MILLIGAN (W. O.), editor. *Clays and clay minerals*. Proc. 3rd Conf. Clays and Clay Mins., Nat. Acad. Sci., Nat. Res. Council, Washington, 1955, Publ. 395, 573 pp., 256 figs., 69 tables. Price \$7.00.

Forty-three papers presented at the 3rd National Clay Conference held at the Rice Institute, Houston, Texas, October 26-29, 1954.

BATES (T. F.) & COMER (J. J.). *Electron microscopy of clay surfaces*. 17 figs. (pp. 1-25).

SAND (L. B.) & COMER (J. J.). *A study in morphology by electron diffraction*. 2 figs. (pp. 26-30).

TAGGART (M. S., Jr.), MILLIGAN (W. O.), & STUDER (H. P.). *Electron micrographic studies of clays*. 29 figs. (pp. 31-64).

WASER (JÜRIG). *The scattering of tubular objects*. Abstract only. (p. 65).

JONAS (E. C.). *The reversible dehydroxylation of clay minerals*. 3 figs. (pp. 66-72).

WEISS (E. J.) & ROWLAND (R. A.). *X-ray diffractometer studies of dehydroxylation*. Abstract only. (p. 73).

HATHAWAY (J. C.). *Studies of some vermiculite-type clay minerals*. 6 figs. (pp. 74-86).

ROY (R.) & ROMO (L. A.). *New data on vermiculite*. Abstract only. (p. 87).

KUNZE (G. W.). *Anomalies in the ethylene glycol solvation technique used in X-ray diffraction*. 3 figs. (pp. 88-93).

BRADLEY (W. F.). *Structural irregularities in hydrous magnesium silicates*. 6 figs. (pp. 94-102).

STONE (R. L.) & ROWLAND (R. A.). *DTA of kaolinite and montmorillonite under water vapor pressures up to six atmospheres*. 6 figs. (pp. 103-116).

MARTIN (R. T.). *Reference chlorite characterization for chlorite identification in soil clays*. 4 figs. (pp. 116-145).

- MIELENZ (R. C.), SCHIELTZ (N. C.), & KING (M. E.). *Effect of exchangeable cation on X-ray diffraction patterns and thermal behavior of a montmorillonite clay.* 6 figs. (pp. 146-173).  
 NAHIN (P. G.). *Swelling of clay under pressure.* 4 figs. (pp. 174-185).  
 WHITE (W. A.). *Water sorption properties of homoionic montmorillonite.* 6 figs. (pp. 186-204).  
 FOSTER (M. D.). *The relation between composition and swelling in clays.* 4 figs. (pp. 205-220).  
 DODD (C. G.), CONLEY (F. R.), & BARNES (P. M.). *Clay minerals in petroleum reservoir sands and water sensitivity effects.* (pp. 221-238).  
 FRYSSINGER (GALEN) & THOMAS (H. C.). *A method for the determination of the cation exchange capacity of clay minerals and soils.* 1 fig. (pp. 239-245).  
 WOODWARD (L. A.). *Variations in viscosity of clay-water suspensions of Georgia kaolins.* 9 figs. (pp. 246-259).  
 WHITEHOUSE (U. G.) & JEFFREY (L. M.). *Peptization resistance of selected samples of kaolinitic, montmorillonitic, and illitic clay materials.* 5 figs. (pp. 260-281).  
 COLEMAN (N. T.) & MCAULIFFE (CLAYTON). *H-ion catalysis by clays.* 1 fig. (pp. 282-289).  
 DAVIS (L. E.). *Ion pair activities in bentonite suspensions.* 4 figs. (pp. 290-295).  
 FOSTER (W. R.), SAVINS (J. G.), & WAITE (J. M.). *Lattice expansion and rheological behaviour relationships in water-montmorillonite systems.* 19 figs. (pp. 296-316).  
 RODES (V. H.). *Method of screening chemical bonding agents for clay soils.* 1 fig. (pp. 317-321).  
 WHITTIG (L. D.) & JACKSON (M. L.). *Interstratified layer silicates in some soils of northern Wisconsin.* 5 figs. (pp. 322-336).  
 HEYSTEK (H.). *Some hydrous micas in South African clays and shales.* 4 figs. (pp. 337-355).  
 BEAVERS (A. H.), JOHNS (W. D.), GRIM (R. E.), & ODELL (R. T.). *Clay minerals in some Illinois soils developed from loess and till under grass vegetation.* 6 figs. (pp. 356-372).  
 KUNZE (G. W.), TEMPLIN (E. H.), & PAGE (J. B.). *The clay mineral composition of representative soils from five geological regions of Texas.* 6 figs. (pp. 373-383).  
 DRISKELL (B. N.). *Chemical, physical, and mineralogical properties of certain soil profiles in the lower Mississippi delta.* (pp. 384-388).  
 ALLEN (V. T.). *Relation of porosity and permeability to the origin of diaspore clay.* 6 figs. (pp. 389-401).  
 ROMO (L. A.) & ROY (R.). *F-OH exchange in layer silicates.* Abstract only. (p. 402).  
 MATHERS (A. C.), WEED (S. B.), & COLEMAN (N. T.). *The effect of acid and heat treatment on montmorillonoids.* 3 figs. (pp. 403-412).  
 KELLER (W. D.), KIERSCH (G. A.), & HOWELL (PAUL). *Argillation of three silicate rocks expressed in terms of ion transfer.* 1 fig. (pp. 413-420).  
 SCHULTZ (L. G.). *Quantitative evaluation of the kaolinite and illite in underclays.* 3 figs. (pp. 421-429).  
 MURRAY (H. H.) & SAYYAB (A. S.). *Clay mineral studies of some recent marine sediments off the North Carolina coast.* 7 figs. (pp. 430-441).  
 HAUSER (E. A.). *The colloid science of important clay minerals.* 27 figs. (pp. 442-472).  
 McMILLAN (W. G.). *Forces and adsorption at solid surfaces.* No figs. (pp. 473-481).  
 CARDWELL (W. T., Jr.). *Swelling clay identification.* Abstract only. (p. 482).  
 SEED (H. B.). *Stability and swell pressure characteristics of compacted clays.* 14 figs. (pp. 483-504).  
 BAPTIST (O. C.) & SWEENEY (S. A.). *The effect of clays on the permeability of reservoir sands to waters of different saline contents.* 4 figs. (pp. 505-515).  
 GOLDBERG (IRVING), TRESCONY (L. J.), CAMPBELL (J. S., Jr.), & WHYTE (G. J.). *Measurement of moisture content and density of soil masses using radio-activity methods.* 14 figs. (pp. 516-548).  
 NORTON (F. H.). *Flow properties of the kaolinite-water system.* 5 figs. (pp. 549-556).  
 DAY (P. R.). *Soil moisture tension measurements: theoretical interpretation and practical application.* 4 figs. (pp. 557-566).

D. C.

## CRYSTAL STRUCTURE OF MINERALS

EITEL (WILHELM). *Structural conversions in crystalline systems and their importance for geological problems.* Geol. Soc. America, Spec. Paper 66, 1958, ix+183 pp., 93 figs. Price \$3.00.

Following a historical introduction (8 pp.) a comprehensive summary of the literature is presented, emphasis being placed on order-disorder relations. The discussion is

organized under the headings: structural conversions — at low temperatures; — in monocrystals of metal alloys; — in sulphides and related ores; — in heteropolar (ionic) compounds; — in oxide compounds and oxysalts; coupled cation replacements in silicates; problems of double compounds; calcite-magnesite-dolomite problems; new aspects of the system  $\text{SiO}_2$ ; derivative structures of the

ca modifications; structural conversions in the alkali-feldspars; — in anorthite and the plagioclase feldspars; polytypism of layer structure silicates; structural conversions of minerals of the cordierite group. The bibliography has over 700 titles. There are both subject and author indexes. [M.A. 14-89] A. P.

BRUNNEN (C.). *Zur Nomenklatur der Gittercomplexe*. Zeits. Krist., 1960, **113**, 142-154, 2 figs.

R. A. H.

BRUNNEN (G.). *Über Raumgruppensymbole*. Zeits. Krist., 1960, **113**, 155-177, 10 figs.

— *Symbole der Gittercomplex*. Ibid., 178-194.

R. A. H.

BRUNNEN (P. A.). *Low angle X-ray scattering from synthetic zeolites; zeolites A, X, and Y*. Journ. Phys. Chem., 1960, **64**, 364-367, 5 figs.

Scattering from synthetic zeolite can be interpreted in terms of disorder among cations. W. T. H.

BRUNNEN (C. H. L.). *Ionic-covalent bonding in crystals*. Nature, 1960, **187**, 590-591.

In a discussion on ionicity of crystals, a distinction is made between structural ionicity associated with a neutral-lattice structure, and charge separation ionicity arising from electronegativity differences. Examples are given.

M. J. LE B.

BRUNNEN (K. P.). *Electronic configuration of cations in some distorted spinels*. Nature, 1958, **181**, 835-836.

C. H. K.

BRUNNENOVSKÁ (A.). *A study of the influence of the asymmetry of the  $K_{\alpha 1}$  X-ray emission line of cobalt and copper on accurate measurements of lattice parameters*. Czechosl. Journ. Phys., 1959, **9**, 348-360.

The asymmetry of X-ray emission lines was found to influence exact measurements of lattice parameters of powdered Ag, and Al. The results obtained with Cu-radiation differ by about  $1.8$  to  $2.2 \times 10^{-4} \text{Å}$  (with a mean square error  $\pm 0.3 \times 10^{-4} \text{Å}$ ). J. N.

BRUNNENOVSKÁ (A.). [Über die Möglichkeit der Verfolgung der Gitterstörungen in den Kristallen durch Röntgenstrahlung verschiedener Wellenlänge.] Čsl. Čas. Fys. [Czechosl. Journ. Phys.], 1957, **7**, 162-166, 1 fig. (In Czech.)

Precise measurement (back-reflexion method) of the lattice parameters was carried out on wolframite crystals which had small continuously varying admixture or homogeneous content of  $\text{O}_2$  0.5%, Cu 1%, Ni 1%; Fe-, Cu-, Co-,

and Mo- $K_{\alpha}$  radiation was used. The results establish the possibility of tracing by use of radiation of different wavelengths lattice changes from the exterior layer into the inside of the crystals of the heavier metallic minerals.

J. N.

STEWART (E. G.) & COOK (B. P.). *Mosaic texture of graphites*. Nature, 1960, **186**, 797-798, 1 fig.

Laue photographs of flakes of natural graphite, taken with a  $50\mu$  diam. X-ray beam, reveal a mosaic structure with strong preferred orientation of the  $a$ -axes of the mosaic sub-blocks and little stacking disorder of layers within each sub-block. D. McK.

STEWART (E. G.), COOK (B. P.), & KELLETT (E. A.). *Dependence on temperature of the interlayer spacing in carbons of different graphitic perfection*. Nature, 1960, **187**, 1015-1016, 1 fig.

M. J. LE B.

GRENVILLE-WELLS (H. J.) & LONSDALE (K.). *X-ray study of laboratory-made diamonds*. Nature, 1958, **181**, 758-759, 2 figs.

The 'forbidden' and 'satellite' reflections found in synthetic diamonds are attributed to islands of face-centred cubic nickel or  $\text{Ni}_3\text{C}$  or some other nickel compound in a state of strain. The transformation from graphitic carbon to diamond could occur via an intermediate carbon structure, which is geometrically cubic, of side  $3.54 \text{Å}$ , but has only rhombohedral symmetry. This structure would give rise to the observed 'satellite' reflections. Such an intermediate structure could scarcely be distinguished from that of the nickel-rich islands. [M.M. 32-185; M.A. 14-407]

C. H. K.

RENNINGER (M.). *Die 'verbotenen' Reflexe von Diamant, Silicium und Germanium*. Zeits. Krist., 1960, **113**, 99-103, 2 figs.

The absolute scattering amplitudes of the 'forbidden' 222 reflection are measured for Si and Ge and compared with earlier results for diamond. R. A. H.

HAYASHI (A.). [The effect of impurity and temperature on the polytypism of silicon carbide]. Journ. Min. Soc. Japan, 1960, **4**, 363-371, 1 fig., 7 tables, (in Japanese).

Chemical analyses and X-ray powder analyses are made of seven SiC crystals. It is found that there is a regular relation between the polytypism of  $\alpha$ -SiC and Al content. With increasing aluminium,  $\alpha$ -SiC transforms in the sequence of  $\alpha$ -II  $\rightarrow$   $\alpha$ -I  $\rightarrow$   $\alpha$ -II  $\rightarrow$   $\alpha$ -III (according to Thibault classification). Aluminium range of each type is presumably 0.05 to 0.10% for  $\alpha$ -I, <0.05% and 0.10 to 0.3%

for  $\alpha$ -II, and  $>0.3\%$  for  $\alpha$ -III, respectively. It is found that a polytype once formed is not transformed to the other polytype by heating. Relation between colour and aluminium content is also discussed. M. S. J.

LAVES (F.). *Al/Si-Verteilungen, Phasen-Transformationen und Namen der Alkalifeldspäte*. Zeits. Krist., 1960, **113**, 265–296, 12 figs.

A survey is given of the Al/Si distributions possible in the alkali feldspars, based on space-group considerations. Changes in the Al/Si distribution that take place under equilibrium conditions as a function of temperature are depicted diagrammatically. A nomenclature is proposed based on the possible Al/Si distributions, and the term 'anorthoclase' is considered at some length. R. A. H.

BROWN (WILLIAM L.). *Lattice changes in heat-treated plagioclases. The existence of monalbite at room temperature*. Zeits. Krist., 1960, **113**, 297–329, 19 figs.

Simple regularities exist in the relationships between the reciprocal lattice angles for the low-temperature plagioclases from  $An_0$  to  $An_{100}$ . On heating at high temperatures, albite shows changes in lattice parameters similar to those due to the substitution of anorthite in the low-temperature series, until high-temperature albite is produced with  $\alpha^* \approx 86.0^\circ$ ,  $\gamma^* \approx 88.0^\circ$ . Further heating causes a progressive change in the lattice parameters of high-temperature albite towards the monoclinic state, until after 70 days at  $1000^\circ\text{C}$  and 35 days at  $1050^\circ\text{C}$  this monoclinic state can exist at room temperature [but a film of glass is reported to have formed around this material]. This 'monalbite' has  $\alpha^* = \gamma^* = 90^\circ 00'$ ,  $\beta^* 63^\circ 50'$ . These changes are believed to be controlled not by the composition but by the degree of Al/Si order, hence the composition cannot generally be determined from the lattice constants. R. A. H.

BROWN (WILLIAM L.). *The crystallographic and petrologic significance of peristerite unmixing in the acid plagioclases*. Zeits. Krist., 1960, **113**, 330–344, 2 figs.

Unmixing of the peristerite type has been investigated in albites and oligoclases of various parageneses; the relationship between unmixing, schiller, and visible (081) lamellae and replacement is discussed. The coexistence in the same rock of the two exsolved phases in separate crystals has not been observed and it is unlikely that it can occur; at low temperatures the anorthite-rich exsolved phase is not stable in rocks. The probable sequence of events during the cooling of a plagioclase in this compositional range is: formation of a homogeneous but disordered crystal, ordering of the crystal, beginning of unmixing, segregation of the exsolved phases into sub-microscopic units, and finally a tendency to further segregation of the exsolved phases into units of 'microscopic' size. R. A. H.

McCONNELL (J. D. C.) & McKIE (D.). *The kinetics of the ordering process in triclinic  $\text{NaAlSi}_3\text{O}_8$* . Min. Mag. 1960, **32**, 436–454, 6 figs.

A kinetic analysis of the experimental data of MacKenzie [M.A. 14–38] on the change in the crystalline modification of  $\text{NaAlSi}_3\text{O}_8$  has been made. An equation for the rate of approach to equilibrium has been obtained and rate constants calculated for each temperature investigated in the range  $450^\circ$ – $1000^\circ\text{C}$ . A plot of the rate constants against temperature reveals a break between  $700^\circ\text{C}$  and  $550^\circ\text{C}$  and it is suggested that a smeared thermal transformation of some magnitude exists in this temperature range. A further analysis of the effect of pressure on the transformation rate suggests direct participation of  $\text{H}^+$  in the process. It has also been suggested that the slow change in the obliquity (measured by  $2\theta_{131} - 2\theta_{1\bar{3}1}$ ) of albite above  $650^\circ\text{C}$  may define a change in the degree of Al/Si order in this temperature range; in the region of  $600^\circ\text{C}$  a rapid change in the degree of Al/Si order is implied. [M.A. 11–327] W. S. M.

BASSETT (WILLIAM A.). *Role of hydroxyl orientation in mica alteration*. Bull. Geol. Soc. America, 1960, **71**, 449–457, 5 figs., 1 pl.

Phlogopite and biotite are generally more susceptible to alteration by ion exchange than muscovite; the clue to this difference is considered to be hydroxyl orientation. Single crystal study with the infrared spectrophotometer established the orientation and bonding of the hydroxyl ions. The dipole moments of the hydroxyl ions in phlogopite, trioctahedral mica, are perpendicular to the cleavage, whereas those in muscovite, a dioctahedral mica, are obliquely orientated. The hydroxyl ions in phlogopite absorb a higher frequency (3700  $\text{C}/\text{m}$ ) infrared than those in muscovite (3600  $\text{C}/\text{m}$ ). Biotite and iron-rich phlogopite generally show absorption at two frequencies, indicating both trioctahedral and dioctahedral configurations. The inclined hydroxyl ions in dioctahedral mica place the potassium ions in a more negative environment than the perpendicular hydroxyl ions in trioctahedral mica. The more negative environment binds the potassium ions more securely in the lattice. A. L. A.

MERKER (L.) & WONDRAUSCHEK (H.). *Neue Verbindungen mit apatitartiger Struktur, III. Weitere Möglichkeiten des isomorphen Ersatzes im Gitter der Blei-Apatite (Pyromorphite)*. Zeits. Krist., 1960, **113**, 475–477.

Synthetic substances with apatite structure derived from pyromorphite are described; the anions of one such material are solely  $\text{SiO}_4$  tetrahedra. The halogen positions of these substances are vacant or only partially occupied, but it is not known whether such conditions may also occur in natural calcium apatites. R. A. H.

YASHI (S.). *Analysis of crystal structure of fluorapatite by nuclear magnetic resonance*. Journ. Chem. Soc. Japan, 1960, **81**, 540–542, (Japanese with English summary, A.38).

J. M. H.

UKHERJEE (B.). *Uraninite and thorianite*. Nature, 1960, **186**, 464–465.

Uraninite and thorianite on heating in air or in vacuo at 900°C exhibit shrinkage of the cubic unit cell and the formation of an additional phase, possibly  $U_3O_8$ , excess oxygen being present in interstitial positions ( $\frac{1}{2}, 0, 0$ ) of the original structure. Progressive shrinkage due to substitution of diogenic  $Pb^{4+}$  for  $U^{4+}$  is likely to be negligible compared with the shrinkage due to variation of the  $U^{4+}:U^{6+}:O$  ratio. Wasserstein's [M.A. 12–585] classification and age determination method are discussed. Lattice parameters are given for uraninite from Bisundni and Gaya, and for thorianite from Ceylon.

D. McK.

ACKAY (A. L.).  $\beta$ -Ferric oxyhydroxide. Min. Mag., 1960, **32**, 545–557, 11 figs.

The X-ray powder pattern of synthetic  $\beta$ -FeOOH can be indexed on a tetragonal unit cell with  $a$  10.48,  $c$  3.023 Å,  $c/a$  = 8. The structure is similar to that of hollandite or of  $MnO_2$  [M.A. 11–238]. On heating, the structure breaks down and  $\alpha$ -Fe $_2$ O $_3$  crystallizes, probably with an intermediate stage involving a spinel phase.

R. A. H.

AN OOSTERHOUT (G. W.) & ROOIJMANS (C. J. M.). *A new superstructure in gamma-ferric oxide*. Nature, 1958, **181**, 44.

Weak lines observed in the powder pattern of a pure preparation indicate that the superstructure has a tetragonal unit cell with  $c/a$  3 and  $a$  8.33 Å, space group  $P4_1$  or  $P4_3$ . A proposed structure based on that of spinel is being refined. Details will be published later.

C. H. K.

ULER (R.) & HELLNER (E.). *Über komplex zusammengesetzte sulfidische Erze. VI. Zur Kristallstruktur des Meneghinits,  $CuPb_{13}Sb_7S_{24}$* . Zeits. Krist., 1960, **113**, 345–372, 5 figs.

A re-examination of meneghinite has shown it to have  $a$  11.363,  $b$  24.057,  $c$   $24 \times 4.128_2$  Å; space group  $Pn2_1m$ . The structure of the sub-cell with  $a=b=c=4.128_2$  Å and space group  $Pbnm$  contains considerable domains possessing a formed galena-NaCl structure. The coordination number of the metal atoms at the boundary of the galena domains increases from 6 to 7, hence some of the octahedral holes in the framework of the S atoms are vacant. The chemical composition derived from the structure determination is in accordance with the formula proposed by Berry & Modder [M.A. 8–286] rather than that of Palache, Richmond, & Finchell. [M.A. 7–387]

R. A. H.

WEITZ (G.) & HELLNER (E.). *Über komplex zusammengesetzte sulfidische Erze. VII. Zur Kristallstruktur des Cosalits,  $Pb_2Bi_3S_5$* . Zeits. Krist., 1960, **113**, 385–402, 4 figs.

The crystal structure of cosalite has been determined by three-dimensional Patterson and Fourier synthesis. It is orthorhombic, with  $a$  19.101,  $b$  23.913,  $c$  4.061 Å; space group  $Pbnm$  [M.A. 7–490]. As for other complex sulphide ores [see preceding abstract] its structure can be derived from the galena type. The distribution of Pb and Bi and the statistical disposal of Cu or Fe are discussed.

R. A. H.

CID (HILDA). *Étude aux rayons X de la cylindrite*. Bull. Soc. franç. Min. Crist., 1960, **83**, 64–65, 1 fig.

The orthorhombic cell of cylindrite has  $a$  17.1,  $b$  11.6,  $c$  70 Å and there is a pseudocubic sub-cell with  $a'=a/3=5.7$ ,  $b'=b/2=5.8$ ,  $c'=c/12=5.8$  Å. Orientation:  $c$  || cylinder axis,  $b$   $\perp$  curved cleavage surface. The X-ray powder reflections are tabulated; strongest reflections are 3.85 Å (10), 2.88 (10), 5.73 (5), 2.04 (5), and 1.44 (5).

R. A. H.

McCONNELL (J. D. C.). *Vaterite from Ballycraig, Larne, Northern Ireland*. Min. Mag., 1960, **32**, 534–544, 2 figs., 1 pl.

The unstable polymorph of  $CaCO_3$ , vaterite, is recorded as a major constituent in a carbonated calcium silicate hydrogel complex formed from larnite at Ballycraig [M.M. 30–293, 672, 32–117]. Re-indexed X-ray powder data for synthetic vaterite, endorsed by electron diffraction data, indicate a hexagonal unit cell with  $a$  7.135,  $c$  8.524 Å,  $Z=6$ ; sp. gr. (calc.) 2.65. Vaterite is shown to correspond to the hypothetical  $CaCO_3$  member of the bastnäsite-synchysite [ $CeFeCO_3$ – $CeFeCO_3$ . $CaCO_3$ ] mineral series [M.A. 12–329] on the basis of extrapolated cell dimensions and optical properties. A structural scheme is proposed in which Ca layers replace the CeF layers in bastnäsite, and in which near-vertical  $CO_3$  groups are present. The stability relations of both natural and cement vaterites are discussed.

R. A. H.

PISTORIUS (C. F. W. T.). *Lattice constants of synthetic gerhardtite (orthorhombic basic cupric nitrate)*. Zeits. Krist., 1960, **113**, 478–480.

Synthetic gerhardtite has  $a$  11.051,  $b$  5.975,  $c$  6.891 Å;  $Z=2$ , D (calc.) 3.504 g/cc. Indexed X-ray powder data are tabulated. [M.A. 3–52]

R. A. H.

BARCLAY (G. A.) & COX (E. G.). *The structure of hemimorphite*. Zeits. Krist., 1960, **113**, 23–29, 1 fig.

The structure of hemimorphite,  $Zn_4(OH)_2Si_2O_7 \cdot H_2O$  [M.A. 5–187] has been redetermined. The  $Si_2O_7$  ion consists of two  $SiO_4$  tetrahedra with a shared corner; the

Si-O-Si angle is  $133^\circ$  and the Si-O distances are  $1.72\text{\AA}$  (central) and  $1.60, 1.62\text{\AA}$  (peripheral). Preliminary results for thortveitite show that it does not have  $2/m$  symmetry and that the Si-O-Si angle is not  $180^\circ$  as formerly supposed [M.A. 4-111, 280]. R. A. H.

YOUILL (R. F.) & STEADMAN (R.). *Mineralogy and crystal structure of greenalite*. Nature, 1958, **181**, 45.

Greenalite is orthorhombic with  $a\ 5.54, b\ 9.59, c\ 7.19\text{\AA}$ . The structure is similar to that of chamosite though there is little or no  $\alpha$ -disorder. The increase in cell dimensions compared with those of chamosite can be attributed to the small amount of aluminium substituting for tetrahedral silicon and octahedral ferrous iron. A full account is to be published later. C. H. K.

MEIER (W. M.). *The crystal structure of natrolite*. Zeits. Krist., 1960, **113**, 430-444, 5 figs.

The structure of natrolite [M.A. 4-464, 5-354] has been confirmed and refined by Fourier methods using three-dimensional data. The cell dimensions are  $a\ 18.30, b\ 18.63, c\ 6.60\text{\AA}$ ; space group  $Fdd2$ . The water is linked to oxygen atoms of the framework by hydrogen bonds having a length of  $2.85$  and  $2.99\text{\AA}$ . Interatomic distances are  $1.62 \pm 0.01\text{\AA}$  for the tetrahedral Si-O bond,  $1.75 \pm 0.02\text{\AA}$  for the tetrahedral Al-O bond, and  $2.37 \pm 0.02\text{\AA}$  for the Na-O bond. The dehydration and cation exchange phenomena of the fibrous zeolites must be attributed to the open intersecting channels between neighbouring chains, and not to the much narrower channels parallel to the fibre axis [M.A. 6-59]. R. A. H.

KROUPA (FR.). [The deformation of a whisker with edge dislocations.] Czechosl. Journ. Phys., 1959, **9**, 332-338. (In Russian.)

An approximate solution is given of the deformation of a plate caused by an edge dislocation lying in the central plane. The results are used to discuss the bending of a whisker as the result of an edge dislocation; in the calculation the whisker is approximated as an infinite band. [Author's summary.] J. N.

KACZÉR (JAN) & GEMPERLE (R.). *A contribution to the domain structure of iron whiskers*. Czechosl. Journ. Phys., 1959, **9**, 306-313.

The paper contains an interpretation of some domain structures on iron whiskers. The closure structure at the end of a whisker grown in the [111] direction and the structures on whiskers strained by axial pressure and bending are dealt with. J. N.

HAYNES (VANCE). *Compromise growth surfaces on pegmatite minerals*. Amer. Min., 1959, **44**, 1089-1096, 4 figs.

The occurrence of polygonal step-sided pyramids on the growth surfaces of many crystals of pegmatite minerals is explained as the result of simultaneous growth of two adjacent crystals with different growth velocities. Examples of cyrtolite, thorite, fluorite, gadolinite, monazite, xenotime and quartz are given. A. C. H.

TAKANO (Y.) & TAKANO (K.). *The problem of the stability of reciprocal main axes in polysynthetic twin*. Journ. Japanese Assoc. Min. Petr. & Econ. Geol., 1959, **43**, 194-202, 5 figs. (Japanese and English summaries.)

The relations between the twinning axes and the reciprocal main axes are discussed, and a conception of the reciprocal lattice for clear and accurate description of twinning is proposed. M. S. J.

WITKE (O.). *Texture de la cuprite fibreuse de Chuquicamata (Chili)*. Bull. Soc. franç. Min. Crist., 1960, **83**, 63.

Cuprite derived from fibrous antlerite at Chuquicamata, Chile, has inherited the fibrous texture of the latter [M.A. 7-223]. X-ray fibre photographs show that the fibre axis is  $10^\circ$ - $15^\circ$  from [111]. This is in contrast to normal fibrous cuprite, the fibre axis of which is [100]. R. A. H.

JESZENSZKY (B.). *Etch figures on sodium chloride crystals*. Nature, 1958, **181**, 559-560, 2 figs.

C. H. K.

## ECONOMIC MINERALS AND ORE DEPOSITS

BOOYSEN (B.). *Pegmatites: Hints to prospectors*. Geol. Survey Union of S. Africa, Information Pamphlet no. 6. 1959, 57 pp. M.M.

ABDULLAEV (H. M.). *Particularities of magmatic phenomena and metallogeny in Central Asia*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **20**, 86-93.

The pre-batholithic stage is characterized by small ultrabasic bodies with a lean chromite, magnetite, and asbestos

mineralization. The batholithic stage is distinguished by intrusions of polyphasic granitoids, ranging from dioritic to alaskitic types. The granitic-alaskitic types are associated with rare-metal pegmatites and greisen ore formations whereas the dioritic-granodioritic series, associated with intensive assimilation, are accompanied by skarn mineralization. The post-batholithic stage is characterized by small fissure intrusions with skarn, fluorite-polymetallic, and fluorite-mercury-antimony deposits. R. A. H.

ER (EDWARD). *Relation of ore deposition to doming in the North American Cordillera*. Geol. Soc. America, Mem. 77, 1960, 117 pp., 34 figs. Price \$4.00.

Many mining districts are associated with structural faults and anticlines that arise from undeformed surroundings. Those associated with domes have radial and concentric fracture patterns, those associated with anticlines have longitudinal and transverse fracture patterns. Detailed descriptions are given of the relations of ore deposits to structure in eight mining districts of the first type and six of the second type, and many other districts are mentioned. The relation of ore deposition to uplift, the distribution of the ore districts in the Cordilleran region, the relation of epithermal deposits to the development of the Cordillera are discussed. It is concluded that the thermal veins were formed from solutions originating in reservoirs much deeper than the sources for other types of epithermal deposits. The bibliography has 163 entries. [M.A. 14-386] A. P.

ANDERSON (C. F.). *The present state of the Witwatersrand controversy*. Mining Mag., 1960, **102**, 84-95, 149-159 & 222-229.

Although many recent studies have favoured a synthetic origin for the banket ores, a critical appraisal shows the new evidence supports the hypothesis of epigenetic mineralization. The uraninite and monazite are contemporaneous with the Bushveld granitization, and post-date deposition of the reefs. Mineralogical studies demonstrate that there has been widespread metasomatic alteration of the rocks of the Witwatersrand geosyncline; it is concluded that the Witwatersrand mineralization is a product of the Bushveld magmatism. [M.A. 14-395, 398, 400] R. A. H.

LEWIS (L. T.). *The genetic problem of uraninite in the South African gold-bearing conglomerates*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **15**, 15-25, 1 fig.

Although regional metamorphism has obliterated or obscured the original nature and relationships of some of the constituents of the conglomerates, intricate intergrowths of ore minerals and other textural and replacement features resemble those found in ore deposits of hydrothermal origin. The distribution of the ores is unrelated to faults and other cross-cutting structures but is intimately related to sedimentary features. It is concluded that both Au and Cu are incorporated into the conglomerates either during deposition of the conglomerates or soon afterwards. [M.A. 13-633, 14-395, 400] R. A. H.

SMITH (ROBERT G.) & THOMPSON (GEORGE A.). *Geology and quicksilver deposits of the Terlingua district, Texas*. Prof. Paper U.S. Geol. Survey, 1959, **312**, 114 pp.

The district is in a province of alkalic igneous rocks; marine sedimentary rocks of Cretaceous age are intruded by many sills, laccoliths, dikes, and plugs that range in composition from rhyolite through analcite-syenite to olivine-basalt. Textures are typical of small intrusives, but the mineral assemblages are sodium-rich, as is shown by their content of sodium orthoclase, sodic pyroxene, and analcite. Alkali-feldspar is common in all the rocks except a few basalts. The quicksilver deposits, formed after the major structural movements, the volcanic activity, and emplacement of the intrusive igneous rocks, contain cinnabar, pyrite, hematite, limonite, calcite, kaolinite, and gypsum; minor minerals are native mercury, marcasite, calomel, fluorite, quartz, aragonite, baryte, melanterite, and jarosite; rare minerals include kleinite, mosesite, eglestonite, terlinguaite, montroydite, natrolite, analcite, anhydrite, epsomite, and alunite. Clay minerals (analyses given) are the most abundant gangue material. The non-metallic minerals were deposited earlier than the metallic minerals. Within the chloride group the sequence of deposition was probably calomel, mosesite, kleinite, terlinguaite, and eglestonite; montroydite and native mercury in some specimens are younger than terlinguaite. Cinnabar appears to be younger than calomel. The deposits were formed by hydrothermal solutions ascending breccia pipes and fractures at temperatures below 300°C and at pressures locally as high as 30 atmospheres. [M.A. 8-249, 324] K. S.

YAJIMA (S.). *Metacinnabar from Sarawak and Japan, with reference to its stability relations to cinnabar*. Min. Journ. [Japan], 1960, **3**, 9-18, 6 figs.

The mode of occurrence of metacinnabar at the Gading mine, Sarawak, is described. Occurrences of the mineral in Japan are summarized. Although some pseudomorphs of cinnabar after metacinnabar have been described in Japan, the two minerals seem to have been precipitated independently from hydrothermal solutions. [M.A. 14-404] M. S. J.

BERNARD (J. H.). *Výskum nerostů tetraedritové skupiny* [Investigation of minerals of the tetrahedrite group]. Věstník Ústř. Ústavu. Geol. [Prague], 1957, **32**, 135-145, (English summary).

Preliminary communication.

Ditto. Rozpravy Českosl. Akad. Věd, ser. MPV, 1957, **67**, 1-30, (Russian and English summaries). Methods and theory.

Ditto. Rozpravy Českosl. Akad. Věd, ser. MPV, 1958, **68**, 1-74, (English summary).

The well-known great chemical variation among tetrahedrites can tell much about the origin and regional

chemical relations, and even contribute to clarification of tectonics. Work on precisely located specimens included mineragraphic studies of textures, semi-quantitative spectrographic analyses, determination as precise as possible of the lattice constants and densities; when practical Hg and Ag were estimated quantitatively; complete analyses were made of a number of specimens. Study of the tetrahedrite ore from the Zips[Spis]-Gömörer Erzgebirge [Slovak Ore Mts.] showed that the Cu atoms can be replaced by Hg (0.5 to 19%), Fe ( $\approx 1$  to 10%), Zn ( $\approx 0.5$  to 10%), Ag ( $1 \times 10^{-2}$  to 1%), and by traces of Cd and Pb. The place of Sb is taken mainly by As and Bi. The lattice dimension  $a$  of these tetrahedrites is affected by the changes in composition and varies from 10.30 to 10.49 Å. Broadly, Hg and As produce the strongest effects; Bi, Zn, and Fe weaker effects. The content of Ag must exceed  $0.6 \pm 0.1\%$  to produce an effect on the lattice parameter. In the Rudňany lodes 'Droždisk' a characteristic variation with depth was statistically proved; the contents of Hg, Ag, and Sb decrease with depth, and at the same time Cu and As increase; at the deepest levels Zn and Pb increase. These changes are demonstrable by characteristic diminution of the lattice constant with depth. By consideration of the chemical composition of the tetrahedrites and the distribution of baryte important conclusions on the tectonics of the ore-deposits are formulated.

J. N.

KOBE (H. W.). *Cu-Ag deposits of the red-bed type at Negra Huanusha in central Peru*. Schweiz. Min. Petr. Mitt., 1960, **40**, 163-176, 14 figs., 3 maps.

The Cu ore is mainly chalcocite with bornite, covellite, and accessory Ag sulphides and Ag. It occurs as disseminations and patches in sandstones. The deposits are small and irregularly lenticular.

M. W.

ADAM (J. W. H.). *On the geology of the primary tin-ore deposits in the sedimentary formation of Billiton*. Geol. en Mijnbouw, 1960, new ser. **22**, Billiton issue, 405-426, 26 figs.

After descriptions of the geology and of the occurrence of the tin-ore lodes, special attention is paid to the mineralogy of the lodes. The most important and persistent are bedding plane lodes, which are in contact with sandstone or other massive rock, e.g. radiolarite. The lodes are mainly replacement deposits formed at high temperature; special characteristics are their richness in iron and sulphur and the fact that wolframite has never been found. A list of all minerals found in the unweathered parts of the tin-ore lodes is given.

P. C. Z.

KROL (G. L.). *Theories on the genesis of the Kaksa*. Geol. en Mijnbouw, 1960, new ser. **22**, Billiton issue, 437-443. 'Kaksa', a local name used in Billiton for the layer in

which cassiterite is concentrated, is found on the valley bottoms, resting directly on bedrock and covered by younger alluvial deposits. The author reviews the different theories of the past hundred years on the genesis of 'kaksa'. The facts that 'kaksa' is found on the valley floors and that it also reflects in its components the type of bedrock which it rests, lead to a controversy between the adherents of a fluvial alluvial genesis and the supporters of a geosynclinal in situ. The importance of creep on 'kaksa' genesis has also been advocated. Discussion of the data and the arguments of recent authors leads to the opinion that 'kaksa' is a residual product of mainly chemical erosion.

C. J. C.

OVEREEM (A. J. A. VAN). *The geology of the cassiterite placers of Billiton, Indonesia*. Geol. en Mijnbouw, 1960, new ser. **22**, Billiton issue, 444-457, 10 figs., 1 table.

After an introductory discussion of the basement rocks, the weathering profile, and the morphology, the author deals with the geological history of the cassiterite concentration. Advancing denudation in the Tertiary may have concentrated cassiterite in the valleys possible; at the end of this period the topography was a very mature one and chemical denudation prevailed over mechanical erosion. Eustatic movements in the Pleistocene were responsible for the incision of the rivers into the weathered basement rocks. Large amounts of lighter sedimentary material were removed while the heavy sedimentary components, including cassiterite, were only slowly transported. The residual material of the valley plains of the late Tertiary therefore thus contains concentrates of cassiterite. A geological map with the known ore deposits of the island of Billiton is included.

C. J. C.

OVEREEM (A. J. A. VAN). *Geological control of dredging operation on placer deposits, Billiton, Indonesia*. Geol. en Mijnbouw, 1960, new ser. **22**, Billiton issue, 458-463, 4 figs., 3 tables.

A technique is described for using the dredges, the main producers of the cassiterite concentrate, as continuous sampling machines. A tin distribution map, based on dredge samples from the Telok Pring area off the north coast of Billiton is given. Cumulative grain size distribution curves of the samples of the bucket-loads point to the possibility that the fine-grained cassiterite was washed from the bottom ore layer consisting of coarse angular debris. The coarse-grained cassiterite and the coarse quartz fragments were probably deposited in an earlier period.

C. J. C.

FICK (L. J.). *On the geology of the tin pegmatites at Kama Southern Rhodesia*. Geol. en Mijnbouw, 1960, new ser. **22**, Billiton issue, 472-491, 20 figs., 3 appendices, 1 map.

tin-bearing pegmatites occur in the Basement System consisting of gneisses, schists, granites, quartzites, and mica-schists. The position, internal structure, and tin content of tin pegmatites is described as well as their mineralogy. Tin-bearing tin-pegmatites have a greater tin content than Li-pegmatites.

P. C. Z.

W. A. W. (S. G.). *The distribution and occurrence of tungsten minerals in South China and Hong Kong*. Proc. 8th Pacific Sci. Congr. (Philippines meeting), 1956 (for 1953), **2A**, 669–675.

W. A. W.

KA (K.). [*Chamosite from the oolitic iron ores of the Bohemian Ordovician*]. Sborník k osmdesátinám akad. F. Slavíka, Úst. Geol., 1957, 255–286. (Russian and German summaries.)

The oolitic sedimentary iron ore 'makovka' ('Mohnerz') in the Jinočany ore district consists of a groundmass of pyrite and oolites of chamosite with kaolinitic, orthorhombic type structure.

J. N.

TEL (G.), BLAIS (R.), KNOWLES (D. M.), & BERGERON (R.). *The Labrador geosyncline*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **9**, 21–38, 3 figs.

Synthesis of various published and unpublished reports of a series of Precambrian strata representing at least three cycles of sedimentation, orogeny, and metamorphism, and which represent one of the largest known reserves of sedimentary iron ore. The Knob Lake area [M.A. 14–257] is in the least metamorphosed portion and includes hematite, magnetite, iron carbonate, and iron silicate rocks believed to be primary in origin. This iron formation has an average iron content of 25–40% and maintains an average thickness of 100 feet over hundreds of square miles. In the southern, more highly metamorphosed portion the iron-bearing sediments have been converted to quartz-specular hematite-magnetite rocks; partial supergene leaching has in some places reduced the silica content.

R. A. H.

YANABE (T.), KATO (A.), & ITO (J.). *The minerals of the Noda-Tamagawa mine, Iwate Prefecture, Japan—II. Pyrochroite ore (Kimiman-ko) and its origin*. Min. Journ. [Japan], 1960, **3**, 30–41, 2 figs., 4 pls., 4 tables.

The manganese ore locally called 'kimiman-ko' at the Noda-Tamagawa mine is composed essentially of pyrochroite [ $\text{Mn}(\text{OH})_2$ ] hitherto known as a rare mineral. The ore consists mainly of fibrous pyrochroite pseudomorphous after manganosite with small amounts of manganosite, pyrochroite, tephroite, rhodochrosite, baryte, and alabandite. Pyrochroite occurs in scaly aggregates. When fresh it is black, but when exposed in air its colour changes to brown. Extinction is parallel to the elongated fibre;

character of zone is positive,  $\epsilon$  1.683,  $\omega$  1.725, and  $\omega - \epsilon$  0.042. Unit cell dimensions obtained from the powder data are  $a$  3.323,  $c$  4.738 Å. Chemical analysis of massive pyrochroite containing a small amount of tephroite, galaxite, Mn-carbonate, alabandite, etc., by J. Ito gave: MnO 72.92,  $\text{MnO}_2$  none,  $\text{H}_2\text{O} +$  17.42,  $\text{SiO}_2$  3.13,  $\text{TiO}_2$  none,  $\text{Al}_2\text{O}_3$  0.18,  $\text{Fe}_2\text{O}_3$  0.42, FeO n.d., MgO 1.06, CaO 2.01,  $\text{CO}_2$  2.70, S 0.28, alkalis n.d., less O for S –0.14, = 99.98; sp. gr. 3.32<sub>6</sub>. The origin of the pyrochroite ore is discussed.

M. S. J.

SOREM (R. K.). *Geology of three major manganese districts of the Philippines*. Proc. 8th Pacific Sci. Congr. (Philippines meeting), 1956 (for 1953), **2A**, 661–666, 1 map.

The localities described are Siquijor Island (about 660 km S.S.E. of Manila), Busuanga Island (about 330 km south of Manila), and the Anda peninsula on Bohol Island (south-west of Leyte). The Anda peninsula is now the most important Mn-producing area in the Philippines.

W. A. W.

STURM (E.). *Possible origins of manganese ore in the Negev*. Bull. Res. Council Israel, 1953, **3**, 177–191, 11 figs., 2 tables.

Sedimentary manganese ore exposed in the erosion cirque of Nahal Timna (Wadi Menayeh) occurs as concretionary nodules of pyrolusite, disseminated  $\text{MnO}_2$ , and placer deposits with some authigenic pyrolusite. It is suggested that the manganiferous sand, silt, and clay were deposited in a lake or shallow sea during a period of discontinuous uplift, having been transported from an old flatland covered by a deep manganiferous soil.

D. H. Y.

SUZUKI (JUN.). *Chromite deposits in Japan*. Proc. 8th Pacific Sci. Congr. (Philippines meeting), 1956 (for 1953), **2A**, 595–599, 1 map.

A brief description, illustrated by a locality map, of Japanese chromite deposits.

W. A. W.

GEFFROY (J.) & SARCIA (J. A.). *Essai d'une classification des gîtes uranifères filoniens*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **15**, 109–113.

Two main categories of uraniferous deposits are distinguished. One of these, related to the differentiation of acid rocks, belongs to the classic hydrothermal group. The other is entirely different and comprises uranium deposits dispersed on a regional scale.

R. A. H.

KATAYAMA (N.). *Genesis of uranium deposits in sedimentary rocks*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **15**, 7–14.

U is concentrated in stagnant water in arid terrestria

basins and precipitated under reducing environment in the presence of  $H_2S$  formed by biological processes. The resultant U deposits are classified as: I, syngenetic, in lacustrine sediments; II, ground water type, (a) basal, with trough-and-channel structure control, (b) sandstone lens, with 'roll' ore, (c) water table type, with enriched zone just below the water table; III, recrystallized, in Archaean conglomerates.

R. A. H.

NININGER (R. D.), EVERHART (D. L.), ADLER (H. H.), & KRATCHMAN (J.). *The genesis of uranium deposits*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 15, 40-50.

Uranium ore genesis is discussed with respect to content, mineralogy, and distribution of U in igneous rocks, and to the geological and geochemical factors governing movement through the earth's crust.

R. A. H.

NOBLE (E. A.). *Genesis of uranium belts of the Colorado Plateau*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 15, 26-39, 6 figs.

The major U deposits of the Colorado Plateau occur within restricted, elongate mineral belts. As no special features of the host rocks account for the location of the ores it is postulated that their deposition was caused by some change in the mineralizing solutions. It is further postulated that the ore deposition results from decreasing pressure in laterally-moving, U-bearing ground water. The U is believed to have been derived from breakdown of uraniferous volcanic debris within the sediments.

R. A. H.

ARMANDS (G.) & LANDERGREN (STURE). *Geochemical prospecting for uranium in northern Sweden; the enrichment of uranium in peat*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 15, 51-66, 9 figs.

A peat deposit 4.5 km. NW of Masugnsbyn, Norrbotten County, Sweden, has the remarkably high average content of 600 p.p.m. uranium: this is related to the occurrence of radioactive springs within the area of peat. It is suggested that the peat has served as a 'collector' for uranium, rare earths, etc., the enrichment in uranium being due to long distance transport of Mg- and Ca-bicarbonates emanating from nearby dolomite whereby the bicarbonate waters served as carriers of uranium.

R. A. H.

ALÍA (MANUEL). *Relaciones entre mineralizaciones uraníferas en España y la evolución morfológica*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 15, 67-72.

Many Spanish radioactive deposits are located on the surface of erosional platforms which are generally Pliocene

in age. Some represent the upper alteration zones primary deposits, others are surface concentrations of leached from surrounding areas when the ground water level was higher and when evaporation was high.

R. A. H.

ARRIBAS (A.). *Mineralogía de los yacimientos españoles de uranio*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 15, 98-108, 1 fig.

In a preliminary review the mineralogical associations and metallogenic features of the main uranium deposits of Spain are grouped according to their origin.

R. A. H.

MIHOLIĆ (S.). *Secondary enrichment of uranium in sediments*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 15, 73-77.

The mechanism of the secondary enrichment of U in sediments from mineral waters is discussed in the light of new data from drilling at the thermal springs of Fojnica and the mofettes [fumaroles] of Klokoti, Bosnia.

R. A. H.

MIESCH (A. T.), SHOEMAKER (E. M.), NEWMAN (W. L.), & FINCH (W. I.). *Chemical composition as a guide to the size of sandstone-type uranium deposits in the Morrison formation on the Colorado Plateau*. Bull. U.S. Geol. Survey, 1960, 1112-B, 17-61. Price 25 cents.

The concentrations of U, Y, Na, Fe, Zr, Mn, Ca, and Ni in 75 mill-pulp samples are significantly related to the size of the deposits represented by means of statistical tests. The methods used to estimate the size of a deposit are based on (1) simple linear-regression theory, (2) multiple-regression theory (long method), and (3) multiple-regression theory (short method). For methods 1 and 2 the estimated size of each deposit can be computed from tables showing the known concentration of U, Y, Na, Fe, Zr, Mn, Ca, and Ni in the deposits, as determined by semiquantitative spectrographic analysis. For method 3 the estimated size or log size can be read directly from a table showing the known concentration of U and Y only. Zr is an intrinsic element contained principally in the detrital syngenetic fraction of the host sandstone. Ca, Mn, and Na are intrinsic elements contained principally in epigenetic (diagenetic) carbonates in the host sandstone. U, Y, and Ni are principal extrinsic elements, introduced into the host sandstone by uranium mineralization or related processes. Some 60% more than half of the Fe is probably intrinsic and the remainder is extrinsic.

K.

CAMERON (EUGENE N.) & WEIS (PAUL L.). *Stratigraphic graphite—a survey*. Bull. U.S. Geol. Survey, 1960, 1082-E, 201-321, 21 figs. Price \$1.25.

K.

ON (JERRY C.) & HINRICHS (E. NEAL). *Beryl-bearing pegmatites in the Ruby Mountains and other areas in Nevada and northwestern Arizona*. Bull. U.S. Geol. Survey, 1960, **1082-D**, 135-200, 9 figs.

Beryl occurs in at least 11 districts in the region, but was found in any district where it had not previously been reported. Muscovite and feldspar are the only other economically important minerals. The most common beryl-bearing minerals are garnet, beryl, tourmaline, fluorite, apatite; less common are chrysoberyl, scheelite, zircon, titanite, sphene, allanite, samarskite, euxenite, gadolinite, monazite, autunite, columbite-tantalite, lepidolite, pyrochlore, and pyrite and other sulphide minerals. The Fe content of beryl in seven districts ranges from 11.9 to 15.5% (based on  $\omega$  measurements). K. S.

LY (HANS). *Paragenetic relations in the main cryolite ore of Ivigtut, south Greenland*. Neues Jahrb. Min., Abhdl., 1960, **94**, 121-139, 1 fig., 5 pls.

The macroscopic constituents of the main cryolite rock in Ivigtut [M.A. **1**-270, **7**-158, **12**-199] are cryolite, quartz, albite, quartz, blende, galena, chalcopyrite, pyrite, and pyrite; a further 20 minerals occur in lesser amounts. The contents of blende (marmatite) indicate ZnS/FeS equilibrium temperatures of 510° to 590°C. Chalcopyrite-bearing blende has an iron content giving lower values but it is assumed that the chalcopyrite was originally in solid solution and the chalcopyrite content of the blende is added to its iron content the equilibrium temperatures obtained are in good agreement. It is not known whether the blende was originally crystallized as the high-temperature monoclinic or low-temperature (monoclinic) form; the inversion temperature is 565°C. R. A. H.

ARD (L.). *History of mineral research in Israel*. Israel Economic Forum, 1955, **6**, 10-38, bibliogr., 146-150.

A review of the occurrence and exploitation of mineral deposits in Israel from Neolithic times to the present. The author mentions phosphates, bitumen, peat, sulphur, potash, salt and other evaporites, nitrates, mineralized waters, clays, limestone, sand, pumice, pegmatite minerals, and Cu, Mn, and Fe ores. The bibliography contains 112 references.

The same issue contains brief general articles on the occurrence of phosphates (Y. K. Bendor), on gypsum, potash, clays, and silica (A. S. Brunfeld & M. Skidelsky), on petroleum, asphalt, and bitumen (J. Coates), and on geology (O. Schaechter). D. H. Y.

FIELD (A. F.) & CLARKE (V. H.). *Mineral resources of the Kerman region, Iran*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **20**, 74-85, 2 figs.

Chromite and magnesite occur in serpentinized Eocene dunites. Galena-blende mineralization is of the replacement type along fissures in Jurassic and Cretaceous limestones. Hematite-magnetite deposits are also replacements mostly in limestones, whereas there is some copper mineralization associated with Eocene volcanics. R. A. H.

WATANABE (T.). *The minerals of the Noda-Tamagawa mine, Iwaté Prefecture, Japan*. 1. Notes on geology and parageneses of minerals. Min. Journ. [Japan], 1959, **2**, 408-421, 4 figs., 2 tables.

Geology, ore deposits, and the parageneses of the minerals of the Noda-Tamagawa mine are described. More than seventy minerals have been found in this mining area including such rare minerals as pyrochroite, manganosite, vredenburgite, yoshimuraite, etc. Parageneses of these minerals are tabulated. Origin of ores is discussed. [M.A. **15**-25] M. S. J.

STRALEY (H. W., III). *Mineral resources of China*. Proc. 8th Pacific Sci. Congr. (Philippines meeting), 1956 (for 1953), **2A**, 610-618.

W. A. W.

STRALEY (H. W., III) & HUGHES (R. D.). *Mineral resources of western Canada*. Proc. 8th Pacific Sci. Congr. (Philippines meeting), 1956 (for 1953), **2A**, 601-609.

W. A. W.

COOPER (JOHN R.). *Some geologic features of the Pima mining district, Pima County, Arizona*. Bull. U.S. Geol. Survey, 1960, **1112-C**, 63-103.

K. S.

FARQUHAR (O. C.). *Geology and asbestos deposits of the Taita Hills, Kenya*. Geol. Survey Kenya, Mem. 2, 1960, 110 pp., 14 figs., 16 pls., 5 tables.

The asbestos is considered to have been formed as a result of local stresses set up during the conversion of peridotites to serpentinites. Magnesian schists which sheathe the ultramafic parent bodies are attributed to metasomatic changes which took place during folding and granitization. Analyses of anthophyllite asbestos from Makinyambu gave SiO<sub>2</sub> 58.98, 60.35, Al<sub>2</sub>O<sub>3</sub> 1.02, 0.25, Fe<sub>2</sub>O<sub>3</sub> + FeO 8.12, 7.29, MgO 26.74, 27.41, CaO 1.54, 0.12, H<sub>2</sub>O + —, 4.08, H<sub>2</sub>O —, 0.28, F —, 0.02, ign. loss 4.27, —, =100.67, 99.80. An iron-rich peridotite contains FeO 65.31, Fe<sub>2</sub>O<sub>3</sub> 12.57 (total iron 59.60). Three specimens of kyanite examined spectrographically for strontium by R. L. Mitchell contained respectively Sr <10, <10, ca. 300, Ba 10, 10, 10, Rb 3, 3, 3, Li <1, ca. 20, ca. 4 p.p.m. (accuracy  $\pm 50\%$ ). W. P.

## EXPERIMENTAL MINERALOGY

DACHILLE (F.) & ROY (R.). *High-pressure phase transformations in laboratory mechanical mixers and mortars.* Nature, 1960, **186**, 34-71.

Automatic mortars and vibrating mixer-grinders produce a spectrum of hydrostatic pressures up to about 15,000 bars, and will perform low→high pressure phase transformations in a few hours. The accompanying shearing stresses markedly accelerate the rate of transformation, but do not alter equilibrium pressures of transformation. [M.A. **13**-270] D. McK.

HELLNER (E.) & EULER (R.). *Hydrothermale und röntgenographische Untersuchungen an gesteinsbildenden Mineralen—I. Über ein geologisches Thermometer auf Grund von Untersuchungen an Biotiten.* Geochim. Cosmochim. Acta, 1957, **12**, 47-56, 1 fig. (English summary.)

Biotites from a granite have been hydrothermally treated from 350°C to 800°C at 500-1000 bars. From 500°C  $\beta$  and  $\gamma$  increase with increasing temperature, and from 650°C 2V (0-15°) increases to 41° at 800°C and 1000 bars. In a biotite-quartz-andesine paragneiss, hydrothermally treated from 400°-700°C at 1000 bars, cordierite appears at about 500°C, and at 600°C biotite undergoes a change from a disordered three-layer type to an ordered six-layer type. Hematite inclusions in the biotites of both granite and paragneiss become orientated between 350° and 400°C. [M.A. **4**-287, **7**-28] R. C.

EULER (R.) & HELLNER (E.). *Hydrothermale und röntgenographische Untersuchungen an gesteinsbildenden Mineralen—II. Über hydrothermale Untersuchungen in Druckbomben mit Temperaturgefälle.* Geochim. Cosmochim. Acta, 1958, **13**, 220-221.

R. C.

EULER (R.) & HELLNER (E.). *Hydrothermale und röntgenographische Untersuchungen an gesteinsbildenden Mineralen—III. Über einen hydrothermal hergestellten Granat (Andradit).* Geochim. Cosmochim. Acta, 1958, **13**, 221-222.

R. C.

EULER (R.) & HELLNER (E.). *Hydrothermale und röntgenographische Untersuchungen an gesteinsbildenden Mineralen—IV. Über hydrothermal hergestellten Ägirinaugit.* Geochim. Cosmochim. Acta, 1958, **14**, 177-178.

Ägirine-augite obtained by heating Na-weilburgite has  $a$  9.806,  $b$  8.940,  $c$  5.284Å,  $\beta$  105°34'; space group  $C2/c$ ;  $\alpha$  1.725,  $\beta$  1.740,  $\gamma$  1.760,  $\alpha:c$  27°, 2V, 83°.

R. C.

EULER (R.) & HELLNER (E.). *Hydrothermale und röntgenographische Untersuchungen an gesteinsbildenden Mineralen—V. Über hydrothermal hergestellte Osumilite.* Geochim. Cosmochim. Acta, 1959, **15**, 156-157.

Osumilite synthesized at 700°-750°C and 1000 bars water vapour pressure has  $\omega$  1.537;  $a$  10.11,  $c$  14.36Å.

R. C.

CHRISTOPHE-MICHEL-LÉVY (M.). *Reproduction artificielle de l'idocrase.* Bull. Soc. franç. Min. Crist., 1960, **83**, 23-25, 1 fig.

Idocrase has been synthesized from  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{CaCO}_3$  and  $4\text{MgCO}_3 \cdot \text{Mg}(\text{OH})_2 \cdot 6\text{H}_2\text{O}$  in stoichiometric proportions corresponding to  $\text{Ca}_{10}\text{Al}_4\text{Mg}_2\text{Si}_9\text{O}_{34}(\text{OH})_4$ , at 1200 bars water vapour pressure and 450-500°C: an Mg-free idocrase has also been prepared [see also COES, Journ. Amer. Ceram. Soc., 1955, **38**, 298; RAPP & SMITH, Bull. Geol. Soc. Amer., 1958, **69**, 1741]. In the presence of  $\text{Na}_2\text{CO}_3$  idocrase forms readily and it is suggested that in natural occurrences the factor controlling whether or not idocrase appears in addition to grossular garnet is the presence of alkalis in solution. Where idocrase is known in contact rocks associated with alkaline intrusions it is probably not of hydrothermal origin.

R. A. H.

CHRISTOPHE-MICHEL-LÉVY (M.). *Sur l'altération de la cordierite.* Bull. Soc. franç. Min. Crist., 1960, **83**, 142-143, 2 figs.

The dominant natural alteration products of cordierite have been shown by X-rays to be chlorite or muscovite. A Madagascar cordierite heated for 7 days in the presence of pure water gave chlorite after treatment at below 450°C. In weak potassium-bearing solutions strong attack took place at 350°C giving hydrophlogopite with a rim of muscovite; the alteration is more marked if alumina is added.

R. A. H.

WYART (J.) & SABATIER (G.). *Sur la mobilité des ions  $\text{Si}^{4+}$  et  $\text{Al}^{3+}$  dans les feldspaths en présence d'eau.* Bull. Soc. franç. Min. Crist., 1960, **83**, 141, 1 fig.

A 'potassic plagioclase', prepared by exchanging part of the sodium of a labradorite by potassium in a melt of  $\text{Na}_2\text{O}$  at 900°C, was heated for 3 days at 600°C under a pressure of nitrogen of 560 bars. This produced no change in the material as studied by X-ray powder diffraction method. Another sample of the same material heated for 24 hours at 600°C under a pressure of water of 560 bars produced plagioclase together with a potassium feldspar. The catalytic role of water in producing this change is improved. The sample which had been previously heated

der 560 bars of nitrogen had to be maintained for several days under a pressure of water to produce the same result; it is suggested that nitrogen is retained in the superficial defects of the crystal where the transformation from one feldspar to two feldspars begins. [M.A. 14-332]

W. S. M.

EMLEY (J. J.). *Hydrolysis of K-feldspar and mica at elevated temperatures and pressures*. Journ. Phys. Chem., 1959, **63**, 320.

Equilibrium constants and standard free energy of reaction were measured at 1000 bars in the range 200–500°C for the reactions:  $\text{K-feldspar} + \text{H}^+ = \text{mica} + \text{silica} + \text{K}^+$ , and  $\text{mica} + \text{H}^+ + \text{water} = \text{kaolin} + \text{K}^+$ . The reactions are exothermic and the equilibria shift to higher acidities with increasing temperature; pressure has little effect.

W. T. H.

SARSSON (G. O.). *Hydrothermal reactions of calcium hydroxide-quartz at 120–220°C*. Journ. Phys. Chem., 1960, **64**, 328–331.

Products are similar to those formed with amorphous silica [M.A. 14-485] and depend on the amount of calcium hydroxide per unit area of quartz grain surface. New X-ray powder data are given.

W. T. H.

SARSSON (G. O.). *Hydrothermal reactions between calcium hydroxide and muscovite and feldspar at 120–220°C*. Journ. Phys. Chem., 1960, **64**, 626–632, 1 fig.

Hydrogarnet (with 50% replacement of silica by hydroxyl), tobermorite,  $\alpha$ -dicalcium silicate monohydrate, and an unidentified mineral (probably a zeolite by its X-ray diffraction data) are formed depending on reaction time and amount of calcium hydroxide per mineral area. [See preceding abstract.]

W. T. H.

STORNIUS (CARL W. F. T.) & KENNEDY (GEORGE C.). *Stability relations of grossularite and hydrogrossularite at high temperatures and pressures*. Amer. Journ. Sci., 1960, **258**, 247–257, 2 figs.

The equilibrium relations between hydrogrossular + quartz and anorthite + wollastonite + water have been determined to 15,500 bars and 810°C by means of the 'simple-pressure' high-pressure apparatus. Thermochemical data are also given for the reaction. The composition of the hydrogrossular, above 500°C and in equilibrium with quartz, is determined almost entirely by temperature. Grossular is stable above 780°C and 15 kilobars  $\text{H}_2\text{O}$  pressure in the presence of quartz.

A. P.

TE (W. S.). *Stability of epidote minerals*. Nature, 1960, **187**, 497.

Previous workers have been unable to synthesize the

epidote group of minerals apparently because of sluggish nucleation. New methods have produced abundant epidote under 2000 bars water vapour pressure, at 505°C and 630°C for 30–80 days. At 715°C anorthite, garnet, and magnetite were formed instead. Further results indicate that below 300°C, zeolites become stable.

M. J. LE B.

SKINNER (BRIAN J.) & EVANS (HOWARD T., Jr.). *Crystal chemistry of  $\beta$ -spodumene solid solutions on the join  $\text{Li}_2\text{O} \cdot \text{Al}_2\text{O}_3 - \text{SiO}_2$* . Amer. Journ. Sci., 1960, **258-A**, 312–324.

$\beta$ -spodumene,  $\text{LiAlSi}_2\text{O}_6$  is tetragonal, space group  $P4_32_1-D_4^8$  or  $P4_12_1-D_4^4$ , with  $a = 7.5332 \pm 0.0008$ ,  $c = 9.1540 \pm 0.0008 \text{ \AA}$ ; isomorphous with keatite,  $\text{SiO}_2$ , with which it forms solid solutions  $\text{Li}_x\text{Al}_x\text{Si}_{1-x}\text{O}_2$  with  $0.16 < x < 0.33$ ; within this range the axes  $a$  and  $c$  vary regularly with  $x$  (precise data given). Solid solutions for which  $0 < x < 0.1451$  are unstable at 1350°C and atmospheric pressure. Channels in the crystal structure permit considerable freedom of movement of Li under the influence of electric fields. Details are given on the equilibrium mixtures of  $\beta$ -spodumene with  $\beta$ -eucryptite [pseudo-eucryptite], and of  $\beta$ -spodumene with tridymite; X-ray powder data for  $\beta$ -spodumene and solid solutions are indexed.

H. W.

WELCH (J. H.). *A new interpretation of the mullite problem*. Nature, 1960, **186**, 545–546, 2 figs.

Hot-stage microscopy shows that mullite of  $3\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2$  composition melts under equilibrium conditions to a more aluminous mullite and a silica-enriched liquid. Mullite of 3:2 composition can perhaps only be crystallized at temperatures below the  $\text{Al}_2\text{O}_3 - \text{SiO}_2$  solidus, in the presence of a third component. Re-determination of the liquidus yields a mullite primary phase region extending to 75%  $\text{Al}_2\text{O}_3$ , where mullite is transformed to corundum + liquid at 1880°C. Refractive index data are given for analysed mullites with 75 to 79.5%  $\text{Al}_2\text{O}_3$ . [M.A. 14-297] D. McK.

YALMAN (R. G.), SHAW (E. R.), & CORWIN (J. F.). *The effect of pH and fluoride on the formation of aluminium oxides*. Journ. Phys. Chem., 1960, **64**, 300–303, 1 fig.

In the range 380–420°C, 250–500 bars, the solubility of corundum is nearly constant at 0.002 wgt.% in distilled water, and 0.38% in 0.1 M NaOH. In this same range the rate of growth of diaspore or corundum from pseudo-boehmite increases rapidly as the solution is varied in composition from acid ( $\text{Al}_2\text{SO}_4$  solution) through distilled water to basic (NaOH solution).

W. T. H.

WINKLER (H. G. F.). *Experimentelle Gesteinsmetamorphose — I. Hydrothermale Metamorphose karbonatfreier Tone*. Geochim. Cosmochim. Acta, 1958, **13**, 42–69, 5 figs. (English summary.)

Two illite-quartz clays and a kaolinite-illite-quartz clay, each carbonate-free, have been hydrothermally treated from about 400°C to 750°C at a water pressure of 2000 atmospheres. Below 400°C illite recrystallizes to muscovite, chlorite (or serpentine) and quartz; at 420°C pyrophyllite appears in the recrystallized kaolinite-rich clay. Above 525°C further reactions yield biotite, sillimanite-mullite (some andalusite in the kaolinite-rich clay), cordierite, and K-feldspar. Under these experimental conditions the upper temperature limit of the greenschist facies for the three clays is 525–550°C, the temperature range of the amphibolite facies is 525–560°C to 660–670°C, and of the pyroxene-hornfels facies 660–670°C to 720°C. Above 700–720°C ultrametamorphism begins and a leucogranitic melt appears accompanied by cordierite  $\pm$  quartz  $\pm$  sillimanite-mullite  $\pm$  corundum  $\pm$  rutile or hematite-ilmenite. The mineral association, weight %, and temperature of formation of the melt depend on the composition of the original clay, but at 725–740°C the leucogranitic melt forms from 40% to as much as 65% by weight of the original clay. R. C.

WINKLER (HELMUT G. F.) & VON PLATEN (HILMAR). *Experimentelle Gesteinsmetamorphose—II. Bildung von anatektischen granitischen Schmelzen bei der Metamorphose von NaCl-führenden kalkfreien Tonen*. Geochim. Cosmochim. Acta, 1959, **15**, 91–112, 7 figs., (English summary).

Illite-quartz clays with NaCl added, from 1.8 to 4.8% by weight, to simulate saline rock-pore solutions, have been hydrothermally treated between 350°C and 800°C at 2000 atm. water pressure. At about 390°C the NaCl-bearing clays yield muscovite, chlorite, plagioclase, HCl, and H<sub>2</sub>O. Above 550°C the amphibolite facies is entered with the assemblage muscovite, biotite, cordierite, plagioclase, quartz; between 600°C and 665°C (temperature inversely  $\propto$  Na content) the pyroxene-hornfels facies with the assemblage alkali-feldspar, cordierite, biotite,  $\pm$  sillimanite-mullite  $\pm$  plagioclase  $\pm$  quartz. At 670°C and 720° (for high and low Na-content respectively) ultrametamorphism begins with the formation of a granitic melt, which at 765°C is as much as 66% by weight of the preceding pyroxene-hornfels stage. The changing composition of the granitic melt with increasing temperature and the petrogenetic significance of the melt are discussed. R. C.

WINKLER (H. G. F.) & VON PLATEN (H.). *Experimentelle Gesteinsmetamorphose—III. Anatektische Ultramorphose kalkhaltiger Tone*. Geochim. Cosmochim. Acta, 1960, **18**, 294–316, 3 figs., (English summary).

Illite-quartz clays with both CaCO<sub>3</sub> and NaCl added in varying amounts have been hydrothermally treated from 715°C to 810°C at 2000 atm. water pressure. Ultramorphism begins at 740°C with the formation of a melt of

K-feldspar + quartz composition which with increasing temperature becomes progressively aplitic, granitic and, at 810°C, granodioritic. There is fractional melting of alkali feldspar and plagioclase and, dependent on the original sample composition, anorthite-rich plagioclase comprises from 60% to 75% of the unliquefied crystals, accompanied by biotite or diopside or a little quartz. The granodioritic melt forms up to 80% by weight of the original sample, and it is suggested that some anorthositic rocks are possibly the unliquefied crystal residues from ultrametamorphism of calcitic illite clays, or shales, after the separation of anatectic granitic magma. R. C.

ELLIOT (J. S.), SHARP (R. F.), & LEWIS (L.). *The effect of the molar Ca/P ratio upon the crystallization of brushite and apatite*. Journ. Phys. Chem., 1959, **63**, 725–729, 1 fig.

The pH below which brushite is stable relative to apatite at 38°C decreases from 6.9 to 4.7 as the mole ratio Ca/P increases from 0.01 to 3.0. W. T. H.

GARD (J. A.), HOWISON (J. W.), & TAYLOR (H. F. W.). *Synthetic compounds related to tobermorite: an electron microscope, X-ray, and dehydration study*. Mag. Concrete Res., 1959, **11**, 151–158, 5 figs.

Tobermorite-like preparations with Ca:Si ratios in the range 0.8–1.4 have been synthesized hydrothermally and at room temperature. One such compound may have a layer structure in which one surface of each layer is composed of hydroxyl groups, analogous in some respects to the hydrated form of halloysite. R. A. H.

GARRELS (R. M.), THOMPSON (M. E.), & SIEVER (R.). *Stability of some carbonates at 25°C and one atmosphere total pressure*. Amer. Journ. Sci., 1960, **258**, 402–413, 5 figs.

Mineral and synthetic carbonates were subjected to dissolving action of water at 25°C, in equilibrium with CO<sub>2</sub> gas at atmospheric pressure; the recorded variation of pH could be extrapolated to infinite time to find an equilibrium value for the pH, which in turn yielded the standard free energy values of formation of the compounds. Data given are for calcite,  $\Delta F_{f,25^\circ\text{C}}^\circ$  –269.8<sub>6</sub>; dolomite –520.0<sub>6</sub>; huntite –1007.7<sub>6</sub>; hydromagnesite –1108.3<sub>6</sub>; natural rhodochrosite –195.7; synthetic precipitated rhodochrosite –194.7; kutnahorite –466.2; aragonite –269.6; witherite –272.0; alstonite –543.0<sub>6</sub>; barytocalcite –542.9<sub>1</sub>; strontianite –272.0<sub>2</sub> kcal/mole. Reliable extrapolation to equilibrium pH was not obtained for magnesite. H. W.

RAZOUK (R. I.) & MIKHAIL (R. S.). *Surface properties of magnesium oxide. II*. Journ. Phys. Chem., 1959, **63**, 1050–1053, 4 figs.

hydration of natural or synthetic brucite gives a linear increase of surface area due to a simple decomposition in the structure, but natural or synthetic magnesite shows a sharp rise of surface area due to collapse of the carbonate structure.

W. T. H.

ALLIE (P. J.) & TUTTLE (O. F.). *Experimental investigation of silicate systems containing two volatile components. Part I. Geometrical considerations.* Amer. Journ. Sci., 1960, **258**, 498–517, 10 figs.

A useful, textbook-like introduction to the geometrical presentation of equilibria as functions of selected variables representing pressure, temperature, and composition ( $T, X$ ), with reference to systems like 'granite'– $H_2O$ – $CO_2$ . The system albite– $H_2O$ – $CO_2$  is capable of developing a 'pinching' effect at constant temperature by contact with quartz which has a dehydrating, and consequently crystallizing effect. The more complex system  $CaO$ – $H_2O$ – $CO_2$  is also briefly summarized on the basis of previously published work. [M.A. 14–406]

H. W.

ALLIET (C.) & MAGNUSSON (B.). *The silicon-boron system.* Nature, 1960, **187**, 54–55.

There is a eutectic at about 3% boron. Data on the structure of  $SiB_4$  is given.

M. J. LE B.

ALLAN (ROBERT F.). *A note on the system  $Fe_2O_3$ – $H_2O$ .* Journ. Geophys. Res., 1959, **64**, 575–579, 4 figs., 1 table.

Hydrothermal data for the reaction goethite  $\rightleftharpoons$  hematite +  $H_2O$  (liq.) in the pressure range 800–1000 bars, combined with a point at 4 bars found by Posnjak and Merwin (p. 2–21) indicate a curve described by the equation  $\log K_f = 130 + 0.0448 P$  (bars). Goethite was synthesized from amorphous ferric hydroxide, but could not be prepared from hematite. Thermodynamic properties of goethite are computed from the phase boundary and known properties of hematite and water. The effects of dissolved salts on the free energy of water are calculated and it is shown that hematite could not form stably in sea water at 25°C or less, nor might be expected in late members of iron-rich oolite sequences. It is suggested that naturally occurring red ferruginous pigments in sediments are usually produced by sub-aerial weathering.

F. R. B.

ALLSTROO (W.). *Spinel phase in the system  $MgO$ – $Fe_2O_3$ – $Al_2O_3$ .* Journ. Inorg. & Nucl. Chem., 1959, **9**, 65–70, 2 figs.

The binary portions of the system  $MgO$ – $Fe_2O_3$ – $Al_2O_3$  are reviewed and completed. The ternary diagram shows a spinel area which increases with increasing temperature. The substitution of  $Al^{3+}$  for  $Fe^{3+}$  in the spinel lowers

the value of the magnetic saturation and the Curie temperature, whereas an increase in the  $Fe_2O_3$  content increases these values. Synthetic samples of h  gbomite composition have been investigated and a possible structure of this mineral is discussed.

R. A. H.

WENTORF (R. H., Jr.). *Condensed systems at high pressures and temperatures.* Journ. Phys. Chem., 1959, **63**, 1934–1940, 9 figs.

Experiments at extreme pressures and temperatures give a phase diagram for diamond–graphite but do not show inversion of forsterite at 130,000 atmospheres ( $T$  not given). Almandine garnet from Gore Mountain, New York, melts incongruently to enstatite and glass at 1185°C and zero pressure. Above 26,000 atmospheres melting is congruent and reversible. Garnet inclusions in natural diamond were probably molten, implying a temperature of formation above about 1300°C. Inclusions of forsterite in natural garnet indicate a pressure greater than 130,000 atmospheres, corresponding to a depth of 400 km.

W. T. H.

NODA (T.) & MATSUOKA (H.). [*Melting of carbon and graphite crystals produced*]. Journ. Chem. Soc. Japan, Industr. Chem. Sect., 1960, **63**, 465–467, 4 figs., 2 tables (In Japanese.)

Charcoal and carbon black were melted by heating under a pressure of more than 100 atm. of argon. Beads of melted carbon of 1 to 3 mm in diam. were obtained; m.p.  $4020 \pm 50^\circ K$ . Lattice constants of melted carbon are  $a = 2.461 \pm 0.0002 \text{ \AA}$ ,  $c = 6.707 \pm 0.0007 \text{ \AA}$ , compared with  $c$  (calc.)  $6.714 \text{ \AA}$  for unmelted carbon. Thin small crystals of melted carbon were observed under an electron microscope.

M. S. J.

KISHI (T.). *Crystalline materials produced by devitrification and corrosion in a melting furnace for amber glass containing  $MnO$ .* Toshiba Review, 1959, **14**, 755–757, 13 figs., 1 table, (Japanese, with English summary).

— *Silica crystals produced by devitrification in glass melting furnaces.* Ibid., 1959, **14**, 1072–1075, 27 figs., 1 table, (Japanese, with English summary).

— *Crystals produced by devitrification of soda-lime-magnesia glass in a melting furnace.* Ibid., 1960, **15**, 61–65, 25 figs., 3 tables, (Japanese, with English summary).

— *Crystals produced by devitrification of soda-lime-magnesia glass (Part II).* Ibid., 1960, **15**, 132–135, 22 figs., 2 tables, (Japanese, with English summary).

The results of microscopic observation of the crystalline materials produced by devitrification and corrosion of various glasses are described. Crystals produced by

devitrification are : albite, pyroxene, devitrite,  $\beta$ -wollastonite from amber glass ; quartz, cristobalite, tridymite,  $\beta$ -wollastonite, devitrite, diopside, plagioclase, alkali-pyroxene, and various minute crystals which have not been identified in the case of soda-lime-magnesia glass ; cristobalite and occasionally tridymite from amber glass ; cristobalite from boro-silica glass. Corrosion products of amber glass are corundum,  $\beta$ -alumina, nepheline, and spinel. Morphological characteristics of these minerals are described.

M. S. J.

NAKA (S.) & NODA (T.). [*Melting point and crystallization temperature of synthetic fluor-phlogopite*]. Journ. Chem. Soc. Japan, Industr. Chem. Sect., 1960, **63**, 232-236, 11 figs., 2 tables, (in Japanese).

—— [Supercooling and crystallization of fluor-phlogopite melt]. Ibid., 1960, **63**, 777-780, 1 fig., 6 photos., 5 tables, (in Japanese).

Measurements by means of quenching and d.t.a. were made of the m.p. and crystallization temperature of synthetic mica ( $\alpha$  1-5170,  $\gamma$  1-5498, 2V 14°). Both m.p. and crystn. temp. were found to be  $1375 \pm 5^\circ\text{C}$ . A few experiments were carried out on the conditions under which supercooling took place. [M.A. 12-518, 13-448, 607]

M. S. J.

KUNITOMI (M.). [*Studies of artificial quartz*]. Rept. Fac. Eng., Yamanashi Univ. (Commemoration of The Tenth Anniversary of the Founding of the Faculty), 1959, **10**, 181-195, 25 figs., 5 tables, (in Japanese).

A brief summary of the researches on synthetic quartz in the writer's laboratory in these years.

M. S. J.

NISHIMURA (J.). *Synthesis of ZnS crystals by sublimation and recrystallization*. Journ. Appl. Phys., Japan, 1959, **28**, 651-656, 4 figs., 5 pls., 3 tables, (in Japanese, with English summary).

A method of preparing 1-10g single crystals of ZnS is described. A polycrystal-body was prepared from powder of ZnS by the sublimation-recrystallization method ; the body consisted of needle-like or prismatic crystals with faces developed in a same orientation. This was then heated for 60 hours in a ZnS atmosphere to produce large single crystals by grain growth. Zn:S ratio of the products was not always 1:1. Low values of S were observed for those prepared at higher temperatures. In the polycrystal-body, (0001) was the growth edge in many cases, while in the final products faces belonging to the zone [1120] formed the growth edge.

M. S. J.

HAYASHI (H.) & NAKA (S.). *Synthesis of nickel-olivine*. Rept. Govt. Industr. Res. Inst., Nagoya, 1960, **9**, 196-201, 7 figs., 8 photos., 4 tables, (Japanese, with English summary).

Nickel-olivine and olivine of the  $(\text{Ni,Mg})_2\text{SiO}_4$  system were synthesized by the following method. A mixture of NiO and MgO is heated at 1400-1500°C in a platinum crucible ; the product is ground, shaped, and heated again at 1400-1500°C for 1-5 hours. An X-ray pattern of olivine type was obtained for the product with the chemical composition of  $\text{Ni}_2\text{SiO}_4$ . Products from test mixtures within the  $(\text{Ni,Mg})_2\text{SiO}_4$  system also showed X-ray patterns of olivine type, indicating the presence of continuous solid solution.

M. S. J.

HAYASHI (H.) & NAKA (S.). *Synthesis of cobalt olivine*. Rept. Govt. Industr. Res. Inst., Nagoya, 1960, 141-146, 6 figs., 10 photos., 4 tables, (Japanese, with English summary).

Cobalt-olivine and olivine of  $(\text{Co,Mg})_2\text{SiO}_4$  system are synthesized from a mixture of chert, CoO from cobalt nitrate, and MgO from magnesium chloride. Raw materials are calcined in a platinum crucible at temperatures between 1350 and 1500°C for one hour. The product is ground again, shaped, and subjected to the same temperatures for one to five hours.  $\text{Co}_2\text{SiO}_4$  and  $(\text{Co,Mg})_2\text{SiO}_4$  are confirmed by X-ray powder method.

M. S. J.

LEAN (J. B.), TUCKER (K. J.), HOLLAND (B. O.), THOMSON (T. R.). *Formation of fayalite in rock-reduced jaspilite*. Nature, 1960, **187**, 683-684, 1 fig.

Fayalite was formed at 650°C at the interfaces of quartz and magnetite under reducing conditions.

M. J. LE B.

RINGWOOD (A. E.). *Olivine-spinel transition on nickel orthosilicate*. Nature, 1960, **187**, 1019.

The equilibrium pressure for the olivine-spinel transition in  $\text{Ni}_2\text{SiO}_4$  at 650°C is about 18,000 atmospheres.  $\text{Ni}_2\text{SiO}_4$  spinel is green, transparent, and has a lattice parameter of 8.044Å. Calculated density is 5.34 gm/cc. The equilibrium of the system  $\text{Ni}_2\text{GeO}_4$ - $\text{Ni}_2\text{SiO}_4$  in which there is complete solid solution will be published elsewhere.

M. J. LE B.

MUAN (ARNULF). *Stability relations among some manganese minerals*. Amer. Min., 1959, **44**, 946-960, 3 figs.

The system manganese oxide-SiO<sub>2</sub> was studied in the temperature range 973°-1206°C and at O<sub>2</sub> partial pressures from 10<sup>-2.5</sup> to 1 atm. Equilibria involving phases Mn<sub>3</sub>O<sub>4</sub>, braunite (Mn<sub>2</sub>O<sub>3</sub>), tephroite (2MnO.SiO<sub>2</sub>), rhodonite (MnO.SiO<sub>2</sub>), and tridymite (SiO<sub>2</sub>) were determined. Equations relating O<sub>2</sub> partial pressures and temperatures are given for 6 univariant situations involving gas and crystalline phases.

A. C. H.

SASAKI (A.). *Variation of unit cell parameters in wolframite series*. Min. Journ. [Japan], 1959, **2**, 375-396, 3 figs., 5 tables.

The variation of unit cell parameters in the wolframites is investigated on the specimens synthesized by fusion of various mixtures of  $\text{FeCl}_2 \cdot 4\text{H}_2\text{O}$ ,  $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}$  and  $\text{WO}_3 \cdot 2\text{H}_2\text{O}$ , as well as on six natural specimens whose chemical data are known. It is found that  $a$ ,  $b$ , and  $c$  increase almost linearly with increasing MnO content, and  $\beta$  varies gradually from  $90^\circ 00'$  in  $\text{FeWO}_4$  to  $91^\circ 11'$  in  $\text{WO}_4$ .

M. S. J.

SPERIN (M.). *Contribution à l'étude de quelques oxydes doubles que forme le tantale avec l'étain, l'uranium et le calcium. Application à la cassitérite et à la bétafite.*

Bull. Soc. franç. Min. Crist., 1960, **83**, 1–21, 4 figs.

X-ray spectrographic determinations of Nb and Ta in cassitérite, and synthetic and experimental work lead to the conclusion that the presence of Ta and Nb is not due to cassitérite-tapiolite isomorphism but is more probably a replacement of  $4\text{Ta}^{5+}$  for  $5\text{Sn}^{4+}$ . Experimentally betafite can be converted into pyrochlore by the addition of 18% Nb<sub>2</sub>O<sub>5</sub>. It is suggested that betafites may have originated as niobiferous and titaniferous pyrochlores which later lost the majority of their calcium. The perovskite and pyrochlore structures are discussed.

R. A. H.

WYART (J.), RUPPLI (C.), & SABATIER (G.). *Réaction du granite fondu sous pression d'eau avec la calcite et une argile. Application en métamorphisme de contact.* Bull. Soc. franç. Min. Crist., 1960, **83**, 128–133, 7 figs.

The reaction of small cylinders of calcite or clay immersed in a granite melted at  $800^\circ\text{C}$  under a water vapour pressure of 1800 bars has been studied. With calcite,  $\text{SiO}_2$  from the 'magma' migrates into the  $\text{CaCO}_3$  which is converted into wollastonite. With clay a liquid is formed together with spinel crystals, and a diffusion of Na and K occurs tending to bring the chemistry of the two portions into line.

R. A. H.

SAUCIER (HENRI). *Nouvelles expériences sur la déformation de roches vitreuses à haute température.* C.R. Acad. Sci. Paris, 1958, **247**, 1214–1217.

Deformation of obsidian (Erivan and Lipari) and of pitchstone (Meissen) has been studied between  $560^\circ$  and  $680^\circ\text{C}$  by a method of simple shearing. The viscosities measured agree with results obtained by other methods; but important delayed elastic deformation has been demonstrated. For comparison experiments have been carried out on an artificial soda-lime glass. E. J. & A. S.

## GEMSTONES

ČERMÁK (J.). *O luminescenci prvního českého diamantu* [On the luminescence of the first Bohemian diamonds]. Časopis Národního musea v Praze, Oddíl přírodovědný, Praha, 1959, **128**, 178–182, (German summary).

The first Bohemian diamond was found in the pyrope-bearing diluvial deposits not far from Dlažkovice; the Bohemian origin was considered indubitable. The second was made in 1927, but the locality was not established. The luminescence of the first diamond, which is in the National Museum in Prague, has been compared with that of others from all over the world. Its luminescence under ultraviolet light is of a quite exceptional yellow-orange colour which was observed in no other of the 8949 pieces tested; even similar luminescence is actually very rare. On the basis of comparison of the crystal morphology of the Bohemian diamond under discussion with the morphology of all specimens in the National Museum collection which show a similar luminescence, the Bohemian one is quite inactive. The luminescence of this diamond is thus a further argument for a Bohemian source.

K. Tě.

The authors draw attention to relationships between the crystal shape and the colour of UV luminescence of diamonds, and have determined the percentage of individual colours of luminescence for as many samples as possible, including 179 specimens from the Mineral Dept. of the National Museum and 8771 cut diamonds from the State Institute for Precious Metals, Prague, of undetermined source locality. Of the Museum diamonds: colourless, white, or bluish diamonds of octahedral or dodecahedral habit either have a blue luminescence or are inactive; coloured diamonds of the same habit show coloured luminescence, rarely are inactive; diamonds of cubic habit have usually a coloured luminescence, and opaque crystals (carbonado) are always inactive. Of the cut diamonds: 58.78% of the brilliant-cut were inactive, the rest colour-luminescent; 77.72% of the lozenge-cut were inactive, the rest colour-luminescent, mostly blue; of industrial diamonds 85.19% were inactive, the rest coloured, mostly blue. White and red colours of luminescence have not been observed so far.

K. Tě.

ČERMÁK (J.) & KUTIL (J.). *A contribution to the luminescence of diamonds.* [Příspěvek k luminescenci diamantu]. Sborník Národního musea v Praze [Acta Musei Nationalis Pragae], 1959, **15B**, no. 5, 185–228, 13 figs., 10 tables, (Czech summary).

CUSTERS (J. F. H.), DYER (H. B.), & RAAL (F. A.). *Simple method of differentiating between natural blue diamonds and diamonds coloured blue artificially.* Journ. Gem-mology, 1960, **7**, 291–293, 2 figs.

Natural blue diamonds are semi-conductors and the passage of minute electric currents from a power source can be detected by earphone. Diamonds coloured blue by bombardment with electrons or  $\gamma$ -rays give no response.

R. A. H.

JAN (J.-P.), STEINEMANN (S.), & DINICHERT (P.). *The density and lattice parameters of ruby*. Phys. Chem. Solids, 1960, **12**, 349-350.

For 20 crystals of synthetic corundum or ruby the cell dimensions showed a linear dependence on the Cr concentration. At 25°C  $a = 4.7591(1 + 0.0527C_m)\text{\AA} \pm 0.0004$ ,  $c = 12.9894(1 + 0.0452C_m)\text{\AA} \pm 0.0030$ , where  $C_m$  = mol. concentration of  $\text{Cr}_2\text{O}_3$  between 0 and 2%. The density, at 25°C, is given by  $3.9860(1 + 0.341C_m) \text{ g/cm}^3 \pm 0.0004$ .

R. A. H.

EPPLER (W. F.). *Healing fissures in peridot*. Journ. Gemmology, 1960, **7**, 301-302, 3 figs.

Oval, partially healed cleavage cracks parallel to (010) of a peridot occur around primary crystal inclusions one of which was found to be a red garnet.

R. A. H.

GOSSE (RALPH C.). *The Greenfield, New York, chrysoberyl locality*. Rocks and Minerals, 1956, **31**, 234-235, 1 fig.

Greenish yellow tabular crystals of chrysoberyl, commonly twinned, occur in a pegmatite dike which cuts Precambrian gneiss. The crystals range up to 1.2 cm by 0.5 cm by 0.5 cm. Terminated black tourmaline crystals are also in the pegmatite. The occurrence was first noted in 1821, but its exact location was only recently rediscovered.

R. S. M.

MORRILL (PHILIP). *A new brazilianite locality*. Rocks and Minerals, 1956, **31**, 128-129.

Small yellow brazilianite crystals are found in the Charle Davis Mine, in a pegmatite northwest of North Groton, New Hampshire. Among twenty minerals also listed from the deposit are lazulite, scorzalite, autunite, torbernite, hercynite, and leucopyrite [löllingite].

R. S. M.

ANON. *Magnificent opal—gift to King of Cambodia*. Rocks and Minerals, 1956, **31**, 126-127, 1 fig.

A description is given of the opal presented to the King of Cambodia by the Australian Government on the occasion of his coronation. The 55-carat precious opal is from the Andamooka opal fields in South Australia.

R. S. M.

KELLEY (CARROLL). *Jade mountains*. Rocks and Minerals, 1956, **31**, 236-237, 1 fig.

An account is given of four jade (nephrite) mountains which were carved during the reign of Emperor Ch'ien Lung, 1736-1796. The largest of these weighed about seven tons and measured seven feet high on three feet square. The four carvings are described in considerable detail.

R. S. M.

LEE (H.) & WEBSTER (R.). *Imitation and treated turquoise*. Journ. Gemmology, 1960, **7**, 249-269, 5 figs.

A review of the history of imitation turquoise from the time of before 4777 B.C. to the twentieth century mixture of bayerite and copper phosphate. Pale chalky natural material from Arizona is bonded with artificial resin to harden it before export to Europe and Asia; some such bonded material is sold to the Navajo and Pueblo Indians in south-west North America who make it into jewellery for sale to tourists. Such chalky turquoise is now also bonded with colloidal silica. Various chemical and other tests for distinguishing bonded and 'improved' turquoises are described in detail. [M.A. 14-121]

R. A. H.

## GEOCHEMISTRY

HAMILTON (W. B.). *Information needed with analytical data*. Geochim. Cosmochim. Acta, 1958, **14**, 253-255.

An appeal for every chemical analysis of material of geochemical or geological interest to be accompanied by a precise location, a brief statement of the mode of occurrence, and a petrographical description of the specimen. To give any less is to forfeit much of the potential of an expensive analysis.

R. A. H.

McKENZIE (R. M.), OERTEL (A. C.), & TILLER (K. G.). *Analyses of the standard rocks G1 and W1*. Geochim. Cosmochim. Acta, 1958, **14**, 68-72, 1 fig.

Spectrographic determinations by a method of successive additions, with no internal standard, are given for Co, Ga, Mn, Mo, Ni, V, and Zr in granite G-1 and diabase W-1. Using available results, evaluation of probable values for true concentrations of these elements shows that none yet known with the accuracy required for standard samples. [M.A. 12-564]

R. C.

WIJS (H. J. DE). *Uit lager sferen. Een beschouwing over het geochemisch gedrag der elementen*. Geol. en Mijnbouw, 1960, new ser. **22**, 57-65, 3 figs., (English summary).

properties of the atom and environmental conditions are possible for the geochemical behaviour of an element. Separate metal and silicate phases in the earth and in the parent body or bodies of meteorites are formed under markedly different conditions. Objections against the classification of Goldschmidt are stated. A new geochemical classification is proposed.

P. C. Z.

NE (GREGOR) & SVEC (HARRY J.). *The absolute abundance of the nitrogen isotopes in the atmosphere and compressed gas from various sources*. *Geochim. Cosmochim. Acta*, 1958, **14**, 234–243.

R. C.

TSUDA (S.). [*Alkali elements in beryl*]. *Journ. Min. Soc. Japan*, 1960, **4**, 398–403, 3 figs., 1 table, (in Japanese).

Quantitative chemical analyses of Rb, Li, and Na are made for 14 beryls from Japan, Korea, and Mongolia. Correlation between the amount of these elements is discussed.  $\text{Rb}_2\text{O}$  (2 to 15 p.p.m.) increases as  $\text{K}_2\text{O}$  increases.  $\text{Li}_2\text{O}$  is nearly constant (10 to 40 p.p.m.). M. S. J.

SHALL (R. R.). *The amounts and isotopic compositions of lead in eclogites from the Münchberg gneiss massif (Fichtelgebirge)*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **13**, 404–417, 1 fig.

Eclogites from the Münchberg area, north-east Bavaria, contain 0.6 to 1.6 p.p.m. Pb. On the basis of their isotopic composition two types of lead are recognised: one type is similar to that of peridotites but different from modern ones, the other is surprisingly radiogenic. On the whole lead in the eclogites differs from that in most rocks, but the amount of Pb and its isotopic composition suggest relationship with the serpentinite of the Münchberg massif.

R. A. H.

BAULT (M. E.) & COPPENS (R.). *Étude radiogéologique d'une partie du massif granitique de Mortagne (Vendée)—France*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **15**, 78–97, 17 figs.

Systematic studies of the distribution of uranium in the suite of the Mortagne batholith allow the relationships between the U content and the amounts of the major elements, and the variation in U distribution as a function of alteration, to be established. The formation of autunite in the altered granite is discussed.

R. A. H.

SEN (ESPER S., 3rd) & GOTTFRIED (DAVID). *Uranium and thorium in selected suites of igneous rocks*. *Amer. Journ. Sci.*, 1960, **258-A**, 151–169, 10 figs.

Data on the U and Th contents are summarized for 199 igneous rocks from Mesozoic batholiths of western U.S.A.

and from volcanic and hypabyssal rocks from Hawaii, Virginia, and western U.S.A. For batholithic rocks U and Th increase in amount from the gabbroic to the granitic but decrease in the acid differentiates although U:Th remains nearly constant. With the exception of some extreme alkalic basalts from Honolulu, the volcanic and hypabyssal rocks show the same kind of variation.

H. W.

MUELLER (G.). *The distribution of uranium in naturally fractionated organic phases*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **15**, 123–132.

Within the hydrothermally differentiated types of bitumens from Windy Knoll, Castleton, Derbyshire [M.A. **13**–128, 139], the U percentage markedly increases with the C/H ratio of the organic mineraloid, and in phases with approx. equal C/H ratios the phase with the higher O/C ratio is the more radioactive. The progressive graphitization of Triassic plant remains in granitized conglomerates in Chile, giving small amounts of bitumens, has also been studied.

R. A. H.

HAMILTON (E.). *Distribution of radioactivity in rocks and minerals and the effect of weathering on determinations of uranium*. *Nature*, 1958, **181**, 697–698.

Alpha-particle activity is linearly proportional to U-content in a series of fresh and weathered differentiated basic rocks. The radioactivity of the principal rock-forming minerals is constant and only increases in certain accessories. Accessory uraninite may be far more common than has been supposed. Radioactivity is often high in the 'iron stain' halo surrounding radioactive minerals. Nuclear emulsion techniques have been used to examine the distribution of radioactivity in zircon from various sources.

D. McK.

MIHOLIĆ (STANKO). *Radioactive waters from sediments*. *Geochim. Cosmochim. Acta*, 1958, **14**, 223–233.

Determinations of temperature and radioactivity are given for 107 mineral waters, almost all issuing from sediments, from sources located throughout Yugoslavia. The average radioactivity of the waters shows distinct maxima for waters issuing from Carboniferous and Cretaceous sediments. Waters passing through ochres and calcareous sinters generally have more ionium and radium than corresponds to the radioactive equilibrium with uranium. In flowing through sinters and ochres mineral waters become enriched in radioactivity, in one instance by a factor of 7.

R. C.

WODZICKI (A.). *Geochemical prospecting for uranium in the lower Buller gorge, New Zealand*. *New Zealand Journ. Geol. Geophys.*, 1959, **2**, 602–612, 4 figs.

The method, based on determination of the U content of stream waters, was found to have little practical value in the region, where prospecting with a scintillometer is much simpler and more effective. Contents of U up to 3.3  $\mu\text{g}$  per litre of water were found.

W. A. W.

LANDIS (E. R.). *Uranium content of ground and surface waters in a part of the central Great Plains*. Bull. U.S. Geol. Survey, 1960, **1087-G**, 223-258, 2 figs.

The average uranium content of 179 water samples from tuffaceous fluviatile rocks ranging in age from Pliocene to Pleistocene is 6.7 parts per billion. Forty-eight samples from Cretaceous shale and limestone of marine origin contain an average of 20.4 p.p.b. U. Sandstone, siltstone, and claystone of terrestrial and near-shore marine origin contain an average of 10.2 p.p.b. U as determined from 83 samples. The pH of the waters ranged from 6.5 to 8.5; the more uraniferous waters are generally alkaline. K. S.

HEM (J. D.) & CROPPER (W. H.). *Survey of ferrous-ferric chemical equilibria and redox potentials*. Water-Supply Paper U.S. Geol. Survey, 1959, **1459-A**, 1-31.

K. S.

HEM (JOHN D.). *Restraints on dissolved ferrous iron imposed by bicarbonate, redox potential, and pH*. Water-Supply Paper U.S. Geol. Survey, 1960, **1459-B**, 33-55.

K. S.

HEM (JOHN D.). *Some chemical relationships among sulfur species and dissolved ferrous iron*. Water-Supply Paper U.S. Geol. Survey, 1960, **1459-C**, 57-73.

K. S.

HEM (J. D.) & SKOUGSTAD (M. W.). *Coprecipitation effects in solutions containing ferrous, ferric, and cupric ions*. Water-Supply Paper U.S. Geol. Survey, 1960, **1459-E**, 95-110.

Precipitates of ferric hydroxide that form when solutions containing ferrous iron are raised in pH or Eh may remove other ions from solution by coprecipitation.

K. S.

RAINWATER (F. H.) & WHITE (W. F.). *The solosphere—its inferences and study*. Geochim. Cosmochim. Acta, 1958, **14**, 244-249, 1 fig.

Summarized synthesis of the inter-relationships of water solutes, water environments, and the processes of transport, alteration, and conversion affecting the water solutes.

R. C.

ANDERSON (D. H.) & HAWKES (H. E.). *Relative mobility of the common elements in weathering of some schist and granite areas*. Geochim. Cosmochim. Acta, 1958, **14**, 204-210, 1 fig.

Rocks and stream waters were sampled in three individual drainage basins (schist, granite, and leucogranodiorite) in northern New England, U.S.A. The relative mobility of an element was calculated as the ratio of its average content in the mineral residues of the water of a stream to its average content in chip samples of the rock drained by the stream. Compared with earlier estimates the results indicate a higher mobility for Mg in temperate weathering. In each drainage area the order of mobility is the same:  $\text{Mg} > \text{Ca} > \text{Na} > \text{K} > \text{Si} > \text{Al} = \text{Fe}$ . In previously published estimates of relative mobility [Smyth, 1913, Polynov, 1937] Mg was third in a sequence otherwise the same. [M.A. 12-275, 276, 546, 13-118]

R. C.

SCHOFIELD (J. C.). *Boron in some New Zealand groundwaters*. New Zealand Journ. Geol. Geophys., 1960, 98-104, 3 figs.

Water analyses are examined in relation to the origin of their boron. In the Waikato district only warm groundwaters are significantly enriched in boron (up to 112 p.p.m.  $\text{HBO}_2$ ). These probably derive most of their heat and some of their salt content from volcanic sources. The boron:anion-equivalent ratios of thermal waters in the Rotorua-Taupo region bear no relation to the dominant anion present or to pH values, but increase south-westward from the Bay of Plenty towards Tongariro National Park. Increasing boron content of thermal waters appears to be associated with increase in basicity of associated volcanism. There is no proof for either a leached or primary magmatic origin for the boron in the waters.

W. A. W.

BIEN (G. S.), CONTOIS (D. E.), & THOMAS (W. H.). *The removal of soluble silica from fresh water entering the sea*. Geochim. Cosmochim. Acta, 1958, **14**, 35-54, 11 figs.

Determinations of soluble silica and chlorinity of water samples (chlorinities 0.1-21‰) from the east Mississippi Delta area show that when river-water enters the sea the soluble silica concentration is reduced by some process other than dilution with sea-water. The degree of biological uptake is difficult to assess but is possibly appreciable after initial water mixing (at chlorinities greater than 8g  $\text{Cl}^-/\text{litre}$ ). The probable major removal process is inorganic precipitation. Laboratory experiments with river-water and sea-water show that electrolytes in sea-water and colloidal or suspended solids in river-water are necessary for maximum inorganic removal. Increased removal with increasing suspended solids indicates adsorption or co-precipitation of soluble silica with suspended solids rather than salt formation.

R. C.

BOWEN (V. T.) & SUGIHARA (T. T.). *Strontium-90 in the 'mixed layer' of the Atlantic Ocean*. Nature, 1960, 171-72.

the variation of  $^{90}\text{Sr}$  concentration with depth indicates special transport during winter, but the data are inadequate to give reliable rates of downmixing of ocean surface-water. The results have applications to the marine chemistry of  $\text{CO}_2$ .  
D. McK.

LINGAR (G. V.). *Chemical composition of oil-field waters from Apsheron Peninsula, Azerbaidzhan SSR: a summary*. Geochim. Cosmochim. Acta, 1958, **14**, 168-172, 1 fig.  
R.C.

NON (HELEN L.). *The development of botanical methods of prospecting for uranium on the Colorado Plateau*. Bull. U.S. Geol. Survey, 1960, **1085-A**, 1-50, 6 figs.

Botanical anomalies and mineralized ground can be related. The distribution of specific herbaceous plants controlled by Se, S, and other trace elements associated with uranium deposits. The U-content of trees rooted in is significantly higher than that of trees rooted in barren land. The most useful plant species is *Astragalus personi*; the distribution of this plant has led to the discovery of several ore deposits. Prospecting by mapping distribution of indicator plants is most effective at altitudes below about 7000 feet, where the ore horizon is less than 40 feet below the surface, and where the ore contains 0.1% or more Se.  
K. S.

DELICH (ALBERT J.) & KLEINHAMPL (FRANK J.). *Botanical prospecting for uranium in the Deer Flat area, White Canyon district, San Juan County, Utah*. Bull. U.S. Geol. Survey, 1960, **1085-B**, 51-84, 3 figs.

The plant-analysis method led to botanically defined anomalies at all known deposits of uranium. The indicator-plant method was not very useful. [See preceding abstract.]  
K. S.

ROBINSON (W. O.), BASTRON (H.), & MURATA (K. J.). *Biogeochemistry of the rare-earth elements with particular reference to hickory trees*. Geochim. Cosmochim. Acta, 1958, **14**, 55-67, 2 figs.

Rare-earth elements are markedly concentrated in the leaves of hickory trees, dried leaves having as much as 2300 p.p.m. total rare-earths. Y, La, Ce, and Nd form 80-91 atomic % of the total rare-earth elements. Leaf and soil samples show large variations in the Ce/(La+Nd) atomic ratio; deviations from the average Ce/(La+Nd) atomic ratio of rocks and Ce-minerals are all low and are linked with the redox reaction of Ce in soils. Data strongly suggest that only in reducing environments does Ce remain trivalent and maintain its normal abundance. In the oxygenated subsoil it becomes quadrivalent, hence less available than the other rare-earths in its group which do not change valency. Hickory trees probably effect little biological fractionation of the rare-earths and take up the rare-earth elements substantially in the proportions in which they are available in the subsoil. Two samples of ground water have 2 and 60 p.p.b. total rare-earth elements. [M.A. 9-54, 55] R. C.

BOWIE (S. H. U.). *Radiometric and geochemical survey techniques*. Nature, 1958, **181**, 594-596.  
C. H. K.

## HISTORY AND BIOGRAPHY

BARSA NOV (G. P.) Барсанов (Г. П.) Значение минералогической школы В. И. Вернадского в Московском университете (1890-1911) для развития современной минералогии [The significance of the mineralogical school of V. I. Vernadsky on the University of Moscow (1890-1911) in the development of modern mineralogy.] Труды Минер. Муз. Акад. Наук СССР. [Trans. Min. Mus. Acad. Sci. U.S.S.R.] 1959, **10**, 31-44.

(1863-1945), namely its predominantly geochemical and dynamic approaches.  
S. I. T.

[BARSA NOV (G. P.) Барсанов (Г. П.) Материалы к биографии академика В. М. Севергина [Biographical materials of the Academician V. M. Severgin]. Труды Минер. Муз. Акад. Наук СССР. [Trans. Min. Mus. Acad. Sci. U.S.S.R.] 1959, **10**, 17-30.

Following up a review of the teaching of mineralogy in the University of Moscow since its foundation in 1755, the author gives an outline of the new current of ideas introduced into the science of mineralogy by V. I. Vernadsky

Additional biographical material of V. M. Severgin [M.A. 13-352] is given. It is, for example, discovered that on completion of his studies in Göttingen in 1788, Severgin was detailed to proceed for further studies to Edinburgh, but owing to the troubled state of Europe at that time, this order was cancelled.  
S. I. T.

## METEORITES AND TEKTITES

VEK (K.). *Katalog sbírky meteoritů Národního musea v Praze—Catalogue of the collection of meteorites of the National Museum in Prague*. Sborník Národního Musea v Praze (Acta Musei Nationalis Pragae), 1958, ser. B, **14**, nos. 1-2, 127 pp., 8 tables, (English, with introduction in Czech).

This is the third catalogue of the meteorite collection in the Prague National Museum; the two earlier, 1904 and 1913, were by K. Vrba. The new catalogue contains precise basic data on all 371 specimens, representing 265 falls or localities, present in the collection and is arranged alphabetically by name of the fall or locality, for each name all

synonyms and the geographical location being appended. Date of fall or discovery, reference to the first notice, systematic designation, and special characters follow with finally the description of one or more specimens from the collection. The tektite collection in the Museum is dealt with separately and for the first time, and for each locality the material is classified under australite, billingtonite, indochinite, phillipinite, and moldavite. V. Š.

ANON. *The Tunguska [Tunguska] meteorite.* Nature, 1960, **187**, 1077-1078.

A report is given on several Russian papers concerning this problematic meteorite. [M.A. **12-250**, **13-51**, **14-126**, 127] M. J. LE B.

GROENEVELD (D.). *A new iron meteorite from Bellsbank, Barkly West district.* Trans. Geol. Soc. S. Africa, 1959, **62**, 75-79, 1 fig., 2 pls.

The meteorite belongs to the Ni-poor subgroup hexahedrite. It consists mainly of kamacite veined by schreibersite. Chemical analyses by C. E. G. Schutte gave for kamacite  $\text{SiO}_2$  0.02,  $\text{MgO}$  0.35,  $\text{H}_2\text{O} + \text{none}$ ,  $\text{H}_2\text{O} -$  0.08, Fe 94.08, Ni 4.53, Co 0.59, P 0.34, C 0.01, Cu 0.02, Ge 0.01, =100.03; and for schreibersite  $\text{SiO}_2$  1.10,  $\text{Al}_2\text{O}_3$  3.20,  $\text{MgO}$  2.10,  $\text{H}_2\text{O} +$  1.33,  $\text{H}_2\text{O} -$  0.50, Fe 68.84, Ni 9.75, Co 0.29, P 12.49, C 0.25, Cu 0.05, =99.90. X-ray diffraction data for schreibersite are included. M. M.

MARSHALL (ROYAL R.). *Calculation of a 'cosmic ray age' for the iron meteorite 'Carbo'.* Nature, 1959, **184**, 117-118, and, 1960, **185**, 89.

The age calculated from the potassium produced by spallation is  $1.3_8 \times 10^9$  years. The accuracy of the determination depends on how well the ratio of the formation cross-sections for  $^{40}\text{K}$  and  $^{41}\text{K}$  is known and on the constancy of the cosmic ray flux. The value agrees well with previous age determinations of this and other meteorites. [See following abstract] C. H. K.

VOSHAGE (H.) & HINTENBERGER (H.). *Calculation of cosmic-ray ages in the iron meteorites 'Carbo' and Treysa.* Nature, 1960, **185**, 88-89.

Relative isotopic abundances of potassium in the Carbo meteorite are  $^{39}\text{K}$  79.5%,  $^{40}\text{K}$  4.8%,  $^{41}\text{K}$  15.7%, a considerable amount of the meteorite potassium being due to bombardment of iron nuclides by high-energy cosmic particles. Laboratory measurement of cross-sections enables approximate radiation ages for the iron meteorites to be determined as 1050-1400 m.y. for Carbo, and 500-670 m.y. for Treysa. The difference in radiation age between the Carbo and Treysa meteorites can be evaluated with more certainty as 350-1250 m.y.; attention is drawn to the existence of so large an age difference. D. McK.

DEUTSCH (S.), PICCIOTTO (E.), & HOUTERMANS (F. G.). *Alpha radioactivity of iron meteorites (second letter).* Geochim. Cosmochim. Acta, 1958, **14**, 173-174.

Alpha activity measurements of Carbo, Toluca, Tamarugal, and Thunda meteorites. [M.A. **13-356**] R. C.

AXON (H. J.). *The sulphide phase of some iron meteorites.* Nature, 1960, **187**, 406-407, 2 figs.

Sulphur printing of troilite in the Walker County hexahedrite showed a fine lamellar structure of troilite and an unidentified light-coloured phase. [M.M. **29-556**] M. J. LE B.

PRZIBRAM (K.). *Do meteorites exist consisting predominantly of feldspar?* Nature, 1960, **186**, 300-301.

Ultra-violet irradiation excites a bluish fluorescence due to organic traces in many natural silicates, but not in terrestrial or meteoritic olivines. Dominantly feldspathic meteorites, if they occur, might fluoresce. D. McK.

RINGWOOD (A. E.). *Silicon in the metal phase of enstatite chondrites.* Nature, 1960, **186**, 465-466.

The lattice parameters of kamacite from six enstatite chondrites are less than that of pure iron due to the presence of 6-18 atomic % of Si in solid solution. A new chemical analysis shows 2.6 atomic % Si in the Pillisfer enstatite chondrodite [M.M. **25-79**]. The Si content of kamacite can be estimated approximately from the lattice parameters assuming 6-8 atomic % of Ni in solid solution. D. McK.

SCHINDEWOLF (U.). *Selenium and tellurium content of stony meteorites by neutron activation.* Geochim. Cosmochim. Acta, 1960, **19**, 134-138.

The average Se and Te contents of four chondritic meteorites as determined by neutron activation analysis are  $9.8 \pm 2.5$  and  $0.61 \pm 0.17$  p.p.m. respectively. These values are lower than those previously reported. The Se content of three achondrites is also recorded. R. A. H.

SCHMITT (R. A.), MOSEN (A. W.), SUFFREDINI (C. S.), LASCH (J. E.), SHARP (R. A.), & OLEHY (D. A.). *Abundances of the rare-earth elements, lanthanum, cerium, and lutetium, in chondritic meteorites.* Nature, 1960, **186**, 863-866.

Abundances of all the rare-earth elements have been determined in the Allegan [M.A. **6-391**] and Richardton [M.A. **1-101**] chondrites by neutron activation; the results are about  $\pm 30\%$  at variance with Noddack's X-ray spectroscopic average abundances after normalization. Abundances of elements of even atomic number are about four times as great as those of odd atomic number. Certain isotopic ratios agree well with those for terrestrial rocks. D. McK.

SON (B.). *Origin of chondrules and chondritic meteorites.* Nature, 1960, **186**, 230–231.

It is suggested that chondrites were formed by the heating of carbonaceous chondrites (perhaps cosmic dust aggregates) above 600°C by close approach to the sun, when olivine and/or orthopyroxene and some metallic iron would be produced. A separate origin for each chondritic meteorite is favoured by textural evidence of crystallization in the absence of a strong gravitational field and by extreme variation in K/A ages. Achondrites, siderites, and pallasites may be disintegration products of a gravitationally differentiated body formed by chondrite aggregation; only these types contain the high pressure mineral diamond.

D. McK.

SON (B.) & WILK (H. B.). *The Tomhannock Creek, New York, chondrite.* Min. Mag., 1960, **32**, 528–534, 1 fig. The Tomhannock Creek chondrite contains olivine ( $\alpha$  1.674,  $\gamma$  1.709), orthopyroxene ( $\alpha$  1.670,  $\gamma$  1.682), glaucophane  $\alpha'$  1.540,  $\gamma'$  1.547), nickel-iron, troilite, chromite, and probably apatite. Chemical analysis of this chondrite (H as H<sub>2</sub>O, both free and combined C as C) gave SiO<sub>2</sub> 88, TiO<sub>2</sub> 0.135, Al<sub>2</sub>O<sub>3</sub> 1.80, Cr<sub>2</sub>O<sub>3</sub> 0.30, FeO 14.94, Fe 36, Ni 1.69, Co 0.07, MnO 0.31, MgO 23.81, CaO 1.39, H<sub>2</sub>O 0.73, K<sub>2</sub>O 0.095, P<sub>2</sub>O<sub>5</sub> 0.36, H<sub>2</sub>O+ 0.34, C 0.10, S 5.26, =99.57; sp. gr. 3.65. The Tomhannock Creek chondrite is not identical with that from Homestead nor that from Yorktown: the Yorktown chondrite appears to have fallen near Yorktown, Westchester Co., New York, September, 1869.

R. A. H.

CEL (JEAN) & JÉRÉMINE (ELISABETH). *Sur la chondrite de Galim (Cameroun).* 83-e Congrès des Sociétés Savantes, 1958, 211–217.

Several small specimens of this chondrite (fall of the 11th Nov., 1952) have been collected. One is metallic and contains some chondrules. The others are composed of olivine, hypersthene, clinohypersthene, troilite, and Ni-Fe; glaucophane, diopside, and merrillite are accessory. A. S.

VERING (J. F.). *Frequency of meteorite falls throughout the ages.* Nature, 1959, **183**, 1664–1665.

Further evidence that meteorites fell before the later tertiary is presented. [M.A. 14–411] C. H. K.

FFEL (L.). *Erosion of meteorites in space and the density of interplanetary gas.* Nature, 1960, **185**, 821–823.

D. McK.

VERING (J. F.). *A typical parent meteorite body.* Geochim. Cosmochim. Acta, 1958, **14**, 174–177.

Reply to critical comment by H. C. Urey of J. F. Vering's paper. [M.A. 14–47]

R. C.

UREY (H. C.). *A typical parent meteorite body—a reply to Dr. J. F. Vering.* Geochim. Cosmochim. Acta, 1959, **16**, 194.

R. C.

LOVERING (J. F.). *A typical parent meteorite body—a reply to Professor Urey.* Geochim. Cosmochim. Acta, 1959, **16**, 195.

R. C.

KOENIGSWALD (G. H. R. VON). *Tektite studies. Part I: The age of the indo-australian tektites. Part II: The distribution of the indo-australian tektites.* Proc. Koninklijke Nederlandse Akad. van Wetenschappen, 1960, ser. B., **63**, no. 2, 135–153, 11 figs., 3 tables.

That these tektites came down early in the Middle Pleistocene is shown by dating by isotopes and application of the radiation curves for the Pleistocene. Localities are described where tektites are found in strata together with fossils. The Indo-Australian tektites occur within a region the long axis of which lies NW-SE, from the Thailand-Burma border and Tonkin in the north to Tasmania in the south, covering the whole of Indonesia and the Philippines and at least part of New Guinea. Surface sculptures and sizes are described in relation to the region where they have been found.

P. C. Z.

BAKER (G.). *Origin of tektites.* Nature, 1960, **185**, 291–294.

A survey of recent work on some 20,000 australites shows that the present distribution and abundance of tektites have been influenced by the effects of atmospheric flight, subaerial disintegration, and interference by animals; no serious objection remains to entry from outer space as a shower. The cometary collision hypothesis is rejected. Study of the excellently preserved australites of Port Campbell, Victoria, indicates that the australites entered the atmosphere with pre-formed primary shapes, which were modified during supersonic, non-rotational flight through the atmosphere.

D. McK.

HAWKINS (G. S.). *Tektites and the Earth.* Nature, 1960, **185**, 300–301.

Consideration of the geochemical ratios least affected by weathering, Ni/Co, D/H, <sup>87</sup>Sr/Sr, Pb isotope ratio, U-Th-Pb balance, and Fe/Ni, lends strong support to the fused terrestrial sediment hypothesis. It is suggested that tektites were produced by the action of lightning on various sediments; artificial tektites have been produced by the action of a high-energy electron beam on sandy clay from the Texas tektite field. The flight form of meteorites is an irregular cone, distinct from the supposed flight forms of tektites.

D. McK.

UREY (H. C.). *Origin of tektites.* Nature, 1960, **187**, 855–857.

Dr. G. Baker's criticism [Nature, **185**–291] of Urey's hypothesis [M.A. **13**–363] is discussed. [M.A. **14**–133]

M. J. LE B.

CHERRY (R. D.), TAYLOR (S. R.), & SACHS (MAUREEN). *Major element relationships in tektites*. Nature, 1960, **187**, 680–681, 1 fig.

It is suggested, on the basis of the major element composition, that tektites may be derived from a quartz-shale mixture in the ratio of 1:3. [M.A. **13**–363]

M. J. LE B.

WHITTEN (E. H. T.). *Average composition of granites, the genesis of tektites, and petrogenesis*. Nature, 1960, **187**, 867–868.

The few analysed 'typical specimens' from any single granitic pluton constitute a totally inadequate sample upon which to estimate the bulk composition of that pluton. Thus to compare the composition of tektites with averages of such 'typical specimens' may be misleading.

M. J. LE B.

FRIEDMAN (I.), THORPE (A.), & SENFTLE (F. E.). *Comparison of the chemical compositions and magnetic properties of tektites and glasses formed by fusion of terrestrial rocks*. Nature, 1960, **187**, 1089–1092.

Twelve new chemical analyses are given of a sand, a bentonite, a basalt glass, an obsidian, and two rhyolites before and after fusing at approx. 2500°C in air at atmospheric pressure. Comparison of the chemical and magnetic data (given) with similar data for tektites taken from the

literature [M.A. **14**–132] suggests that tektites were formed by heating of surface material in situ nor lightning.

M. J. LE B.

BARNES (V. E.). *Significance of inhomogeneity in tektites*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 3, 328–338, 1 pl.

Petrographical details are given for 37 tektites. It is believed that lechatelierite in tektites originated from quartz similar to that in terrestrial volcanic rocks and that tektites were melted at a temperature in excess of 1710°C and remained molten for only a short time. Australite, indochinites, and Java tektites may all belong to the same shower. Two tektite showers are recognised in Texas, the younger of which may be correlated with Georgia tektites. [M.A. **14**–132]

R. A. H.

HODGE (P. W.) & WILDT (R.). *A search for airborne particles of meteoritic origin*. Geochim. Cosmochim. Acta, 1958, **14**, 126–133, 6 figs.

Daily collections of atmospheric dust made simultaneously for one year at three widely separated isolated North American sites regularly contained opaque specularly reflecting spherules, almost all less than 10μ in diameter. Rate of fall (1.1 spherules > 3μ diam. per cm<sup>2</sup> per day) and frequency-size distribution were the same at each site. This, with the known formation of spherules during meteorite ablation [M.A. **12**–252, **13**–42, **43**, **47**, **14**–49] suggests meteoritic origin. Assuming the spherules have the density of magnetite, the computed accretion of particles 3–10μ diam. is about 5 × 10<sup>8</sup> kg/year for the entire earth. [M.A. **11**–265]

R. C.

## MINERAL DATA

TOKUDA (T.). *The X-ray powder patterns and the lattice constants of natural cristobalites*. Min. Journ. [Japan], 1960, **3**, 1–8, 1 fig., 2 tables.

Eight-seven powder lines, including back reflections, were obtained for three purified natural cristobalites. Specimens were purified by treating with fluoboric acid. M. S. J.

OKAMOTO (Y.), SAKURAI (K.), & KATO (A.). [Pyrophanite from Oyamada]. Journ. Min. Soc., Japan, 1959, **4**, 307–309, 1 fig., 1 table, (in Japanese).

Morphological and X-ray data for pyrophanite from Oyamada, Aichi Prefecture, Japan, are given; *a* 5.137, *c* 14.28Å. X-ray fluorescence analysis shows the presence of Mn, Ti, and Fe (Mn:Fe=10:1). M. S. J.

OKADA (K.). *Thermal study on some γ type ramsdellites*. Journ. Japanese Assoc. Min. Petr. & Econ. Geol., 1959, **43**, 229–238, 6 figs., 2 tables, (Japanese and English summaries).

The X-ray powder diagram of the manganese dioxide mineral from the Iwasaki manganese mine, Aomori Prefecture, Japan, is similar to that of γ-MnO<sub>2</sub> described by Ch. Wadsley, and Walkley in 1947.

M. S. J.

HARIYA (Y.). *A new find of groutite, HMnO<sub>2</sub>, in Japan*. Journ. Fac. Sci., Hokkaido Univ., 1959, ser. 4, **2**, 255–267, 3 figs., 2 tables, 2 photos.

Platy crystals of groutite were found in the Pirika mine, Hokkaido, Japan, associated with manganite, quartz, baryte, and limonite. Sp. gr. is 4.183 at 4°C. The presence of Mn is confirmed by microchemical and X-ray fluorescence analyses. Anisotropism is very strong. D.t.a. curve shows two endothermic peaks at 395°C and 980–1020°C. Three X-ray powder lines are observed, the strongest being at *d* (Å)=4.19 (73), 2.37 (40), 2.67 (30).

M. S. J.

L (JEAN), HÉNIN (STÉPHANE), & CAILLIÈRE (SIMONNE). *Sur la présence de stainiérîte à Bou Azzer et les propriétés de cet hydroxyde*. C.R. Acad. Sci., Paris, 1958, **246**, 792-795.

stainiérîte [heterogenite] which up till now has been considered an oxyhydroxide of cobalt  $\text{CoO}(\text{OH})$  analogous to stannite  $\text{FeO}(\text{OH})$  is really a hydroxide  $\text{Co}(\text{OH})_2$  of the type of brucite  $\text{Mg}(\text{OH})_2$ . Stainiérîte forms one of the products of oxidation of cobalt arsenides at the Bou Azzer deposit. [M.A. 14-411] E. J. & A. S.

UE (A.). *Paragenesis of minerals of ludwigite series*. Journ. Japanese Assoc. Min. Petr. & Econ. Geol., 1959, **43**, 309-317, 5 figs., 1 table, (Japanese and English summaries).

Mode of occurrence of paigeite from the Kamaishi mine, Iwate Pref., Japan, and the difference in the paragenesis of paigeite and ludwigite are described. Assuming a similarity of temperature, pressure, and chemical potentials of  $\text{H}_2\text{O}$ ,  $\text{Na}_2\text{O}$ ,  $\text{K}_2\text{O}$ , and  $\text{B}_2\text{O}_3$  in pore fluids during the formation of paigeite and ludwigite, it is concluded that the paigeite and associated minerals were formed where the chemical potential of  $\text{O}_2$  in pore fluids was low while that in the system was high, whereas for ludwigite, the opposite conditions obtained. M. S. J.

MONT (C.) & GUILLEMIN (C.). *La dundasite de Gonnessa (Sardaigne)*. Bull. Soc. franç. Min. Crist., 1960, **83**, 121-124, 2 figs.

Dundasite was found in a trial gallery at Gonnessa, northwest of the San Giovanni mine in the Iglesias region of Sardinia. It occurs in two forms; A, in spherulites and fibroidal groups on cerussite; B, white dense masses, sometimes pseudomorphous after cerussite or gibbsite. X-ray powder data are tabulated. The fibres show straight extinction, and are optically negative with  $\alpha$  1.602,  $\gamma$  1.750. D.T.A. curve shows a strong endothermic peak between 400 and 450°C and a weaker exothermic peak at 680°C. Conditions for the formation of dundasite are discussed. Chemical analysis gave for A and B respectively  $\text{PbO}$  45.7,  $\text{ZnO}$  0.4, 1.8,  $\text{Al}_2\text{O}_3$  20.8, 23.4,  $\text{CO}_2$  17.8, 18.6,  $\text{H}_2\text{O} +$  13.2,  $\text{SiO}_2$  1.2, 2.1, = 99.1, 100.4. [M.M. 14-167, R. A. H.]

(L.) & SYNEČEK (VL.). *Bismutové nerosty z Krupky a Krušných horách. [Bismuth minerals from Krupka (Graupen) in the Krusné Hory (Erzgebirge)]*. Univ. Carolina, Geologica, 1957, **3**, no. 1, 1-45, (Czech, with Russian and English summaries).

The pegmatitic-pneumatolytic association was studied petrographically. In the quartz veins were found bismuth, stannite, a mineral closely similar to aikinite, and the

new mineral kettnerite [A.M. 43-385; M.A. 14-198]. Kettnerite,  $\text{CaF} \cdot \text{BiO} \cdot \text{CO}_3$ , has  $a$   $3.79 \pm 0.02$ ,  $c$   $13.59 \pm 0.03 \text{ \AA}$ ,  $c/a = 3.59$ ; goniometrically  $c/a = 3.57$ ; space group  $P4/nmm$ ; optically -ive,  $\omega$  2.05. Structural analysis had not been completed. J. N.

GAY (P.) & RICKSON (K. O.). *X-ray data on stokesite*. Min. Mag., 1960, **32**, 433-435.

The type specimen of stokesite,  $\text{CaSnSi}_3\text{O}_{11}\text{H}_4$ , occurring on a matrix of axinite from Roscommon Cliff, St. Just, Cornwall [M.M. 12-274], has  $a$  14.41,  $b$  11.61,  $c$  5.23 Å,  $Z=4$ , space group  $Pnna$ . Strongest lines in the X-ray powder pattern occur at 3.99, 2.89 and 7.25 Å, but the 2.89 Å reflection is at least a doublet. Transformation from the morphological to the structural orientation gives the properties as  $\alpha$  1.609  $\parallel c[001]$ ,  $\beta$  1.6125  $\parallel a[100]$ ,  $\gamma$  1.619  $\parallel b[010]$ ,  $2V_\gamma$   $69\frac{1}{2}^\circ$ ; perfect {101} and imperfect {100} cleavages. R. A. H.

COOMBS (D. S.) & LAUDER (W. R.). *Note on xonotlite from Acheron River, mid-Canterbury*. New Zealand Journ. Geol. Geophys., 1960, **3**, 72-73.

Xonotlite found as veins in a teschenite sill has the following properties:  $\gamma$  (parallel to fibres) 1.593,  $\beta \approx \alpha$  1.584 (both  $\pm 0.002$ ), sp. gr. 2.69 ( $\pm 0.01$ ). Analysis by J. A. Ritchie gave  $\text{SiO}_2$  50.0,  $\text{R}_2\text{O}_3$  0.1,  $\text{CaO}$  46.5,  $\text{H}_2\text{O} +$  2.96,  $\text{H}_2\text{O} -$  0.2,  $\text{CO}_2$  0.26, = 100.02. Spectrographic examination gave Fe 0.2, Al 0.02, K 0.02. W. A. W.

DEARMAN (W. R.) & CLARINGBULL (G. F.). *Bavenite from the Meldon aplite quarries, Okehampton, Devonshire*. Min. Mag., 1960, **32**, 577-578, 1 fig.

Bavenite is recorded from a fissure with quartz, albite, and fluorite, in a pneumatolytic reaction vein in the Meldon aplite [M.M. 20-140, 29-799]. The bavenite occurs as an incomplete rosette of colourless crystals up to 6 mm long, elongated parallel to [001], the largest faces {010} modified by {120} being striated in the  $c$  direction. The crystals are terminated by {041}; they have  $\alpha$  1.584,  $\gamma$  1.590,  $2V_\gamma$   $48^\circ$ ;  $\alpha \parallel c[001]$ ;  $D^{19}_\gamma$  2.73. A qualitative spectrographic examination showed Ge in addition to Ca, Al, and Si. [M.M. 25-495; A.M. 45-757]. R. A. H.

KATO (T.). *[Heulandite and chabazite from Hashikaké-zawa, Chichibu mine, Saitama Prefecture]*. Journ. Min. Soc., Japan, 1959, **4**, 299-306, 3 figs., 5 tables, (in Japanese).

Heulandite and chabazite crystals occur in a skarn druse at Hashikaké-zawa, Chichibu mine, Japan, associated with garnet, epidote, axinite, and calcite. For heulandite:  $\alpha$  1.503,  $\beta$  1.504,  $\gamma$  1.510,  $2V(+)$   $74^\circ$ ,  $r > v$ ; crystal forms,  $b$  {010},  $c$  {001},  $t$  {201},  $m$  {110}, and  $s$  {201}; analysis gave

SiO<sub>2</sub> 57.29, Al<sub>2</sub>O<sub>3</sub> 16.73, Fe<sub>2</sub>O<sub>3</sub> 0.13, CaO 6.36, SrO 0.85, K<sub>2</sub>O 2.74, Na<sub>2</sub>O 0.75, H<sub>2</sub>O+ 11.54, H<sub>2</sub>O- 3.89, =100.28. For chabazite:  $\alpha$  1.488,  $\gamma$  1.490, 2V( $\pm$ ) 0°; crystal form,  $r$  {10 $\bar{1}$ 1}; chemical analysis, SiO<sub>2</sub> 44.19, Al<sub>2</sub>O<sub>3</sub> 19.86, Fe<sub>2</sub>O<sub>3</sub> 0.28, MgO 1.56, CaO 8.61, SrO 0.15, K<sub>2</sub>O 2.05, Na<sub>2</sub>O 1.18, H<sub>2</sub>O+ 14.36, H<sub>2</sub>O- 7.44, =99.68. X-ray diagrams, thermal data, and spectrographic analyses are also given.  
M. S. J.

MATSUMOTO (Y.) & MIYAHISA (M.). [*Ferrohastingsite from the Obira mine, Kyushu, Japan*]. Journ. Min. Soc., Japan, 1960, **4**, 372-382, 1 fig., 1 pl., 5 tables, (in Japanese).

Ferrohastingsite from the Obira mine occurs as fibrous aggregates, associated with hedenbergite, andradite, and vesuvianite. Colour, dark green; H. 5.5-6; sp. gr. 3.32;  $\alpha$  1.695,  $\beta$  1.710,  $\gamma$  1.713, 2V(-) 29°,  $\gamma:c$  16.5°;  $\alpha$  greenish brown,  $\beta$  olive green,  $\gamma$  bluish green. Chemical analysis by H. Matsumoto gave SiO<sub>2</sub> 38.82, TiO<sub>2</sub> 0.58, Al<sub>2</sub>O<sub>3</sub> 9.07, Fe<sub>2</sub>O<sub>3</sub> 5.57, FeO 25.87, MnO 0.25, MgO 1.91, CaO 11.79, Na<sub>2</sub>O 2.79, K<sub>2</sub>O 0.92, H<sub>2</sub>O+ 2.31, H<sub>2</sub>O- 0.27, F 0.06, Cl 0.20, (less 0 for F and Cl 0.07) =100.34. X-ray powder pattern is identical with those of monoclinic amphiboles. D.t.a. curve is also presented.  
M. S. J.

MINATO (H.). *Melilite crystals in the cavity of blast-furnace slag*. Min. Journ. [Japan], 1959, **2**, 422-426, 2 figs., 1 table.

The melilite crystals are stout prismatic, consisting of a tetragonal prism and the base, colourless and transparent, with vitreous lustre. Melilite phenocrysts in slag show characteristic zonal structure. From the optical properties of each zone, it is found that the core is highest in content of gehlenite, while the rim is lowest. The crystals in the cavity do not show distinct zonal structure. Chemical analyses by the author are: A, pure crystal in cavity, B, specimen of inner zone (not the core) of melilite phenocrysts in slag.

|   | SiO <sub>2</sub> | TiO <sub>2</sub> | Al <sub>2</sub> O <sub>3</sub> | Fe <sub>2</sub> O <sub>3</sub> | MgO  | CaO   | Ign. loss | H <sub>2</sub> O | Total  |
|---|------------------|------------------|--------------------------------|--------------------------------|------|-------|-----------|------------------|--------|
| A | 28.25            | 1.23             | 23.47                          | 1.97                           | 4.45 | 40.58 | 0.84      | nil              | 100.79 |
| B | 29.05            | 0.53             | 20.87                          | 2.00                           | 6.64 | 40.20 | 0.98      | nil              | 100.27 |

The mechanism of crystallization of the mineral is discussed.  
M. S. J.

FONT-ALTABA (M.). *A thermal study of thaumasite*. Min. Mag., 1960, **32**, 567-572, 4 figs.

The d.t.a. curve for thaumasite, occurring with apophyllite and pennine at Bull Runn Quarry, Centerville, Virginia, shows an endothermal peak at 206°C, corresponding to the loss of CO<sub>2</sub> and H<sub>2</sub>O, and a weak exothermal peak at 709°C, corresponding to recrystallization to a mixture of anhydrite and larnite. Indexed X-ray powder data for thaumasite are given; the strongest reflections are at 9.66

(10), 3.79 (7 $\frac{1}{2}$ ), and 4.58 (6 $\frac{1}{2}$ )Å. Cell dimensions are  $a$  10.99,  $c$  10.311Å. [M.M. **32**-416; M.A. **1**-33, **2**-189, **5**-237-356, **14**-497]  
R. A. H.

VEEN (A. H. VAN DER). *The alteration of pyrochlore fersmite in the Mbeya carbonatite*. Geol. en Mijnbouw, 1960, new ser. **22**, Billiton issue, 512-515, 4 figs., 1 table.

Needle-shaped structures occur in pyrochlore crystals. Physical properties, difficult to measure, are given of the needles:  $\alpha$  2.08-2.09,  $\gamma$  2.15-2.16, H. about 4 to 5,  $2V$  probably +,  $\gamma-\alpha$  probably between 0.06 and 0.08. The Nb-content is probably between 70 and 80%. From the data together with X-ray powder diffraction analysis it may be concluded that the needles are probably fersmite crystals.  
P. C. Z.

HONGSLO (T.) & LANGMYHR (F. J.). *On the chemical composition of blomstrandine and euxenite*. Norsk Geologisk Tidsskr., 1960, **40**, 157-164.

The authors earlier described [Anal. Chim. Acta, 1960, **22**, 301] a method for separation and gravimetric determination of Nb, Ta, and Ti, and now apply it to complex substances, namely, two Norwegian blomstrandines from Iveland (A) and Hidra (B), and two Norwegian euxenites from Kragerø (C) and Farsund (D). Preparation of samples for analysis and the analytical procedures are described. Complete analyses of the minerals including trace elements and the individual rare earths were also made. The results are given in two tables from which are taken the following percentages: Nb<sub>2</sub>O<sub>5</sub>, Ta<sub>2</sub>O<sub>5</sub>, TiO<sub>2</sub>,  $\Sigma$  rare earths, respectively, (A) 17.72, 4.29, 31.71, 24.90; (B) 14.26, 2.59, 35.27, 27.71; (C) 23.19, 0.49, 25.45, 22.70; (D) 23.49, 2.55, 25.62, 25.77.  
I. W. O.

BOUSKA (V.). *Příspevek k poznání písekity*. [Contribution to knowledge of pisekite]. Rozpravy Csl. Akad. věd, Praha, 1960, **70**, 35 pp., (Czech, with Russian and English summaries).

The author used electron diffraction as well as X-ray diffraction and the other usual methods of examination in studying the complex metamict mineral pisekite from the pegmatites of Pisek, Bohemia. It was proved that the mineral is not strictly amorphous but consists mainly of an isotropic phase with a small proportion of an anisotropic crystalline phase composed of the simple oxides of the rare earths. The minerals amfangabéite, samarskite, ytterbium tantalite, euxenite, and aeschynite were studied in the same way.  
J. N.

KATO (T.). *Pyromorphite from the Yawa tin lode mine, Burma*. Min. Journ. [Japan], 1960, **3**, 42-44, 1 table.

romorphite from the Yawa Tin Lode mine, Burma, as aggregations of short prismatic crystals with (100),  $c$  (0001), and small  $x$  (10 $\bar{1}$ 1). They are greenish to dark brownish yellow in colour, optically uniaxial negative, with pleochroism,  $\omega$  pale yellow,  $\epsilon$  nearly colourless, absorption  $\omega > \epsilon$ , not radioactive. Chemical analysis by the author gave; PbO 80.52, P<sub>2</sub>O<sub>5</sub> 16.18, As<sub>2</sub>O<sub>5</sub> 0.90, FeO 0.40, —O(=Cl) 0.56 = 99.44. Spectrographic analyses gave Ag, As, Bi, Ca, Cr, Cu, Fe, Si as minor elements and Cd, Mg, Mn, Sn, Zn as trace elements. The relative atomic abundance of Pb determined by the ionization method is <sup>204</sup>Pb:<sup>206</sup>Pb:<sup>207</sup>Pb:<sup>208</sup>Pb = 1.0:17.4:14.7:36.9. X-ray powder data are given,  $a$  10.00,  $c$  7.33 Å. M. S. J.

MAKI (Y.). [*Bindheimite from Chichibu mine*]. Journ. Min. Soc., Japan, 1959, **4**, 310–312, 1 table, (in Japanese).

Bindheimite was found in the Chichibu mine, Saitama Prefecture. Under the microscope, it is yellowish brown,

transparent, optically isotropic, refr. ind.  $1.98 \pm$ . X-ray powder data are in good agreement with those obtained by Mason & Vitaliano. [M.M. **30**–100] M. S. J.

YOSHIMURA (T.) & YOSHINAGA (M.). [*Barites from some manganese ore deposits in the Tamba mountain region*]. Journ. Japanese Assoc. Min. Petr. & Econ. Geol., 1960, **44**, 1–6, 2 figs., 3 tables, (Japanese, with English summary).

Mineralogical descriptions of baryte found at five manganese ore deposits in the Tamba mountain region, Kyoto, Japan. Optical properties and chemical analysis by the authors of a specimen from the Kihata mine are as follows:  $\alpha$  1.636,  $\beta$  1.637,  $\gamma_1$  1.646,  $\gamma_2$  1.646,  $\gamma_3$  1.646,  $\gamma_4$  1.646,  $\gamma_5$  1.646,  $\gamma_6$  1.646,  $\gamma_7$  1.646,  $\gamma_8$  1.646,  $\gamma_9$  1.646,  $\gamma_{10}$  1.646,  $\gamma_{11}$  1.646,  $\gamma_{12}$  1.646,  $\gamma_{13}$  1.646,  $\gamma_{14}$  1.646,  $\gamma_{15}$  1.646,  $\gamma_{16}$  1.646,  $\gamma_{17}$  1.646,  $\gamma_{18}$  1.646,  $\gamma_{19}$  1.646,  $\gamma_{20}$  1.646,  $\gamma_{21}$  1.646,  $\gamma_{22}$  1.646,  $\gamma_{23}$  1.646,  $\gamma_{24}$  1.646,  $\gamma_{25}$  1.646,  $\gamma_{26}$  1.646,  $\gamma_{27}$  1.646,  $\gamma_{28}$  1.646,  $\gamma_{29}$  1.646,  $\gamma_{30}$  1.646,  $\gamma_{31}$  1.646,  $\gamma_{32}$  1.646,  $\gamma_{33}$  1.646,  $\gamma_{34}$  1.646,  $\gamma_{35}$  1.646,  $\gamma_{36}$  1.646,  $\gamma_{37}$  1.646,  $\gamma_{38}$  1.646,  $\gamma_{39}$  1.646,  $\gamma_{40}$  1.646,  $\gamma_{41}$  1.646,  $\gamma_{42}$  1.646,  $\gamma_{43}$  1.646,  $\gamma_{44}$  1.646,  $\gamma_{45}$  1.646,  $\gamma_{46}$  1.646,  $\gamma_{47}$  1.646,  $\gamma_{48}$  1.646,  $\gamma_{49}$  1.646,  $\gamma_{50}$  1.646,  $\gamma_{51}$  1.646,  $\gamma_{52}$  1.646,  $\gamma_{53}$  1.646,  $\gamma_{54}$  1.646,  $\gamma_{55}$  1.646,  $\gamma_{56}$  1.646,  $\gamma_{57}$  1.646,  $\gamma_{58}$  1.646,  $\gamma_{59}$  1.646,  $\gamma_{60}$  1.646,  $\gamma_{61}$  1.646,  $\gamma_{62}$  1.646,  $\gamma_{63}$  1.646,  $\gamma_{64}$  1.646,  $\gamma_{65}$  1.646,  $\gamma_{66}$  1.646,  $\gamma_{67}$  1.646,  $\gamma_{68}$  1.646,  $\gamma_{69}$  1.646,  $\gamma_{70}$  1.646,  $\gamma_{71}$  1.646,  $\gamma_{72}$  1.646,  $\gamma_{73}$  1.646,  $\gamma_{74}$  1.646,  $\gamma_{75}$  1.646,  $\gamma_{76}$  1.646,  $\gamma_{77}$  1.646,  $\gamma_{78}$  1.646,  $\gamma_{79}$  1.646,  $\gamma_{80}$  1.646,  $\gamma_{81}$  1.646,  $\gamma_{82}$  1.646,  $\gamma_{83}$  1.646,  $\gamma_{84}$  1.646,  $\gamma_{85}$  1.646,  $\gamma_{86}$  1.646,  $\gamma_{87}$  1.646,  $\gamma_{88}$  1.646,  $\gamma_{89}$  1.646,  $\gamma_{90}$  1.646,  $\gamma_{91}$  1.646,  $\gamma_{92}$  1.646,  $\gamma_{93}$  1.646,  $\gamma_{94}$  1.646,  $\gamma_{95}$  1.646,  $\gamma_{96}$  1.646,  $\gamma_{97}$  1.646,  $\gamma_{98}$  1.646,  $\gamma_{99}$  1.646,  $\gamma_{100}$  1.646,  $\gamma_{101}$  1.646,  $\gamma_{102}$  1.646,  $\gamma_{103}$  1.646,  $\gamma_{104}$  1.646,  $\gamma_{105}$  1.646,  $\gamma_{106}$  1.646,  $\gamma_{107}$  1.646,  $\gamma_{108}$  1.646,  $\gamma_{109}$  1.646,  $\gamma_{110}$  1.646,  $\gamma_{111}$  1.646,  $\gamma_{112}$  1.646,  $\gamma_{113}$  1.646,  $\gamma_{114}$  1.646,  $\gamma_{115}$  1.646,  $\gamma_{116}$  1.646,  $\gamma_{117}$  1.646,  $\gamma_{118}$  1.646,  $\gamma_{119}$  1.646,  $\gamma_{120}$  1.646,  $\gamma_{121}$  1.646,  $\gamma_{122}$  1.646,  $\gamma_{123}$  1.646,  $\gamma_{124}$  1.646,  $\gamma_{125}$  1.646,  $\gamma_{126}$  1.646,  $\gamma_{127}$  1.646,  $\gamma_{128}$  1.646,  $\gamma_{129}$  1.646,  $\gamma_{130}$  1.646,  $\gamma_{131}$  1.646,  $\gamma_{132}$  1.646,  $\gamma_{133}$  1.646,  $\gamma_{134}$  1.646,  $\gamma_{135}$  1.646,  $\gamma_{136}$  1.646,  $\gamma_{137}$  1.646,  $\gamma_{138}$  1.646,  $\gamma_{139}$  1.646,  $\gamma_{140}$  1.646,  $\gamma_{141}$  1.646,  $\gamma_{142}$  1.646,  $\gamma_{143}$  1.646,  $\gamma_{144}$  1.646,  $\gamma_{145}$  1.646,  $\gamma_{146}$  1.646,  $\gamma_{147}$  1.646,  $\gamma_{148}$  1.646,  $\gamma_{149}$  1.646,  $\gamma_{150}$  1.646,  $\gamma_{151}$  1.646,  $\gamma_{152}$  1.646,  $\gamma_{153}$  1.646,  $\gamma_{154}$  1.646,  $\gamma_{155}$  1.646,  $\gamma_{156}$  1.646,  $\gamma_{157}$  1.646,  $\gamma_{158}$  1.646,  $\gamma_{159}$  1.646,  $\gamma_{160}$  1.646,  $\gamma_{161}$  1.646,  $\gamma_{162}$  1.646,  $\gamma_{163}$  1.646,  $\gamma_{164}$  1.646,  $\gamma_{165}$  1.646,  $\gamma_{166}$  1.646,  $\gamma_{167}$  1.646,  $\gamma_{168}$  1.646,  $\gamma_{169}$  1.646,  $\gamma_{170}$  1.646,  $\gamma_{171}$  1.646,  $\gamma_{172}$  1.646,  $\gamma_{173}$  1.646,  $\gamma_{174}$  1.646,  $\gamma_{175}$  1.646,  $\gamma_{176}$  1.646,  $\gamma_{177}$  1.646,  $\gamma_{178}$  1.646,  $\gamma_{179}$  1.646,  $\gamma_{180}$  1.646,  $\gamma_{181}$  1.646,  $\gamma_{182}$  1.646,  $\gamma_{183}$  1.646,  $\gamma_{184}$  1.646,  $\gamma_{185}$  1.646,  $\gamma_{186}$  1.646,  $\gamma_{187}$  1.646,  $\gamma_{188}$  1.646,  $\gamma_{189}$  1.646,  $\gamma_{190}$  1.646,  $\gamma_{191}$  1.646,  $\gamma_{192}$  1.646,  $\gamma_{193}$  1.646,  $\gamma_{194}$  1.646,  $\gamma_{195}$  1.646,  $\gamma_{196}$  1.646,  $\gamma_{197}$  1.646,  $\gamma_{198}$  1.646,  $\gamma_{199}$  1.646,  $\gamma_{200}$  1.646,  $\gamma_{201}$  1.646,  $\gamma_{202}$  1.646,  $\gamma_{203}$  1.646,  $\gamma_{204}$  1.646,  $\gamma_{205}$  1.646,  $\gamma_{206}$  1.646,  $\gamma_{207}$  1.646,  $\gamma_{208}$  1.646,  $\gamma_{209}$  1.646,  $\gamma_{210}$  1.646,  $\gamma_{211}$  1.646,  $\gamma_{212}$  1.646,  $\gamma_{213}$  1.646,  $\gamma_{214}$  1.646,  $\gamma_{215}$  1.646,  $\gamma_{216}$  1.646,  $\gamma_{217}$  1.646,  $\gamma_{218}$  1.646,  $\gamma_{219}$  1.646,  $\gamma_{220}$  1.646,  $\gamma_{221}$  1.646,  $\gamma_{222}$  1.646,  $\gamma_{223}$  1.646,  $\gamma_{224}$  1.646,  $\gamma_{225}$  1.646,  $\gamma_{226}$  1.646,  $\gamma_{227}$  1.646,  $\gamma_{228}$  1.646,  $\gamma_{229}$  1.646,  $\gamma_{230}$  1.646,  $\gamma_{231}$  1.646,  $\gamma_{232}$  1.646,  $\gamma_{233}$  1.646,  $\gamma_{234}$  1.646,  $\gamma_{235}$  1.646,  $\gamma_{236}$  1.646,  $\gamma_{237}$  1.646,  $\gamma_{238}$  1.646,  $\gamma_{239}$  1.646,  $\gamma_{240}$  1.646,  $\gamma_{241}$  1.646,  $\gamma_{242}$  1.646,  $\gamma_{243}$  1.646,  $\gamma_{244}$  1.646,  $\gamma_{245}$  1.646,  $\gamma_{246}$  1.646,  $\gamma_{247}$  1.646,  $\gamma_{248}$  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$\gamma_{290}$  1.646,  $\gamma_{291}$  1.646,  $\gamma_{292}$  1.646,  $\gamma_{293}$  1.646,  $\gamma_{294}$  1.646,  $\gamma_{295}$  1.646,  $\gamma_{296}$  1.646,  $\gamma_{297}$  1.646,  $\gamma_{298}$  1.646,  $\gamma_{299}$  1.646,  $\gamma_{300}$  1.646,  $\gamma_{301}$  1.646,  $\gamma_{302}$  1.646,  $\gamma_{303}$  1.646,  $\gamma_{304}$  1.646,  $\gamma_{305}$  1.646,  $\gamma_{306}$  1.646,  $\gamma_{307}$  1.646,  $\gamma_{308}$  1.646,  $\gamma_{309}$  1.646,  $\gamma_{310}$  1.646,  $\gamma_{311}$  1.646,  $\gamma_{312}$  1.646,  $\gamma_{313}$  1.646,  $\gamma_{314}$  1.646,  $\gamma_{315}$  1.646,  $\gamma_{316}$  1.646,  $\gamma_{317}$  1.646,  $\gamma_{318}$  1.646,  $\gamma_{319}$  1.646,  $\gamma_{320}$  1.646,  $\gamma_{321}$  1.646,  $\gamma_{322}$  1.646,  $\gamma_{323}$  1.646,  $\gamma_{324}$  1.646,  $\gamma_{325}$  1.646,  $\gamma_{326}$  1.646,  $\gamma_{327}$  1.646,  $\gamma_{328}$  1.646,  $\gamma_{329}$  1.646,  $\gamma_{330}$  1.646,  $\gamma_{331}$  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$\gamma_{373}$  1.646,  $\gamma_{374}$  1.646,  $\gamma_{375}$  1.646,  $\gamma_{376}$  1.646,  $\gamma_{377}$  1.646,  $\gamma_{378}$  1.646,  $\gamma_{379}$  1.646,  $\gamma_{380}$  1.646,  $\gamma_{381}$  1.646,  $\gamma_{382}$  1.646,  $\gamma_{383}$  1.646,  $\gamma_{384}$  1.646,  $\gamma_{385}$  1.646,  $\gamma_{386}$  1.646,  $\gamma_{387}$  1.646,  $\gamma_{388}$  1.646,  $\gamma_{389}$  1.646,  $\gamma_{390}$  1.646,  $\gamma_{391}$  1.646,  $\gamma_{392}$  1.646,  $\gamma_{393}$  1.646,  $\gamma_{394}$  1.646,  $\gamma_{395}$  1.646,  $\gamma_{396}$  1.646,  $\gamma_{397}$  1.646,  $\gamma_{398}$  1.646,  $\gamma_{399}$  1.646,  $\gamma_{400}$  1.646,  $\gamma_{401}$  1.646,  $\gamma_{402}$  1.646,  $\gamma_{403}$  1.646,  $\gamma_{404}$  1.646,  $\gamma_{405}$  1.646,  $\gamma_{406}$  1.646,  $\gamma_{407}$  1.646,  $\gamma_{408}$  1.646,  $\gamma_{409}$  1.646,  $\gamma_{410}$  1.646,  $\gamma_{411}$  1.646,  $\gamma_{412}$  1.646,  $\gamma_{413}$  1.646,  $\gamma_{414}$  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$\gamma_{456}$  1.646,  $\gamma_{457}$  1.646,  $\gamma_{458}$  1.646,  $\gamma_{459}$  1.646,  $\gamma_{460}$  1.646,  $\gamma_{461}$  1.646,  $\gamma_{462}$  1.646,  $\gamma_{463}$  1.646,  $\gamma_{464}$  1.646,  $\gamma_{465}$  1.646,  $\gamma_{466}$  1.646,  $\gamma_{467}$  1.646,  $\gamma_{468}$  1.646,  $\gamma_{469}$  1.646,  $\gamma_{470}$  1.646,  $\gamma_{471}$  1.646,  $\gamma_{472}$  1.646,  $\gamma_{473}$  1.646,  $\gamma_{474}$  1.646,  $\gamma_{475}$  1.646,  $\gamma_{476}$  1.646,  $\gamma_{477}$  1.646,  $\gamma_{478}$  1.646,  $\gamma_{479}$  1.646,  $\gamma_{480}$  1.646,  $\gamma_{481}$  1.646,  $\gamma_{482}$  1.646,  $\gamma_{483}$  1.646,  $\gamma_{484}$  1.646,  $\gamma_{485}$  1.646,  $\gamma_{486}$  1.646,  $\gamma_{487}$  1.646,  $\gamma_{488}$  1.646,  $\gamma_{489}$  1.646,  $\gamma_{490}$  1.646,  $\gamma_{491}$  1.646,  $\gamma_{492}$  1.646,  $\gamma_{493}$  1.646,  $\gamma_{494}$  1.646,  $\gamma_{495}$  1.646,  $\gamma_{496}$  1.646,  $\gamma_{497}$  1.646,  $\gamma_{498}$  1.646,  $\gamma_{499}$  1.646,  $\gamma_{500}$  1.646,  $\gamma_{501}$  1.646,  $\gamma_{502}$  1.646,  $\gamma_{503}$  1.646,  $\gamma_{504}$  1.646,  $\gamma_{505}$  1.646,  $\gamma_{506}$  1.646,  $\gamma_{507}$  1.646,  $\gamma_{508}$  1.646,  $\gamma_{509}$  1.646,  $\gamma_{510}$  1.646,  $\gamma_{511}$  1.646,  $\gamma_{512}$  1.646,  $\gamma_{513}$  1.646,  $\gamma_{514}$  1.646,  $\gamma_{515}$  1.646,  $\gamma_{516}$  1.646,  $\gamma_{517}$  1.646,  $\gamma_{518}$  1.646,  $\gamma_{519}$  1.646,  $\gamma_{520}$  1.646,  $\gamma_{521}$  1.646,  $\gamma_{522}$  1.646,  $\gamma_{523}$  1.646,  $\gamma_{524}$  1.646,  $\gamma_{525}$  1.646,  $\gamma_{526}$  1.646,  $\gamma_{527}$  1.646,  $\gamma_{528}$  1.646,  $\gamma_{529}$  1.646,  $\gamma_{530}$  1.646,  $\gamma_{531}$  1.646,  $\gamma_{532}$  1.646,  $\gamma_{533}$  1.646,  $\gamma_{534}$  1.646,  $\gamma_{535}$  1.646,  $\gamma_{536}$  1.646,  $\gamma_{537}$  1.646,  $\gamma_{538}$  1.646,  $\gamma_{539}$  1.646,  $\gamma_{540}$  1.646,  $\gamma_{541}$  1.646,  $\gamma_{542}$  1.646,  $\gamma_{543}$  1.646,  $\gamma_{544}$  1.646,  $\gamma_{545}$  1.646,  $\gamma_{546}$  1.646,  $\gamma_{547}$  1.646,  $\gamma_{548}$  1.646,  $\gamma_{549}$  1.646,  $\gamma_{550}$  1.646,  $\gamma_{551}$  1.646,  $\gamma_{552}$  1.646,  $\gamma_{553}$  1.646,  $\gamma_{554}$  1.646,  $\gamma_{555}$  1.646,  $\gamma_{556}$  1.646,  $\gamma_{557}$  1.646,  $\gamma_{558}$  1.646,  $\gamma_{559}$  1.646,  $\gamma_{560}$  1.646,  $\gamma_{561}$  1.646,  $\gamma_{562}$  1.646,  $\gamma_{563}$  1.646,  $\gamma_{564}$  1.646,  $\gamma_{565}$  1.646,  $\gamma_{566}$  1.646,  $\gamma_{567}$  1.646,  $\gamma_{568}$  1.646,  $\gamma_{569}$  1.646,  $\gamma_{570}$  1.646,  $\gamma_{571}$  1.646,  $\gamma_{572}$  1.646,  $\gamma_{573}$  1.646,  $\gamma_{574}$  1.646,  $\gamma_{575}$  1.646,  $\gamma_{576}$  1.646,  $\gamma_{577}$  1.646,  $\gamma_{578}$  1.646,  $\gamma_{579}$  1.646,  $\gamma_{580}$  1.646,  $\gamma_{581}$  1.646,  $\gamma_{582}$  1.646,  $\gamma_{583}$  1.646,  $\gamma_{584}$  1.646,  $\gamma_{585}$  1.646,  $\gamma_{586}$  1.646,  $\gamma_{587}$  1.646,  $\gamma_{588}$  1.646,  $\gamma_{589}$  1.646,  $\gamma_{590}$  1.646,  $\gamma_{591}$  1.646,  $\gamma_{592}$  1.646,  $\gamma_{593}$  1.646,  $\gamma_{594}$  1.646,  $\gamma_{595}$  1.646,  $\gamma_{596}$  1.646,  $\gamma_{597}$  1.646,  $\gamma_{598}$  1.646,  $\gamma_{599}$  1.646,  $\gamma_{600}$  1.646,  $\gamma_{601}$  1.646,  $\gamma_{602}$  1.646,  $\gamma_{603}$  1.646,  $\gamma_{604}$  1.646,  $\gamma_{605}$  1.646,  $\gamma_{606}$  1.646,  $\gamma_{607}$  1.646,  $\gamma_{608}$  1.646,  $\gamma_{609}$  1.646,  $\gamma_{610}$  1.646,  $\gamma_{611}$  1.646,  $\gamma_{612}$  1.646,  $\gamma_{613}$  1.646,  $\gamma_{614}$  1.646,  $\gamma_{615}$  1.646,  $\gamma_{616}$  1.646,  $\gamma_{617}$  1.646,  $\gamma_{618}$  1.646,  $\gamma_{619}$  1.646,  $\gamma_{620}$  1.646,  $\gamma_{621}$  1.646,  $\gamma_{622}$  1.646,  $\gamma_{623}$  1.646,  $\gamma_{624}$  1.646,  $\gamma_{625}$  1.646,  $\gamma_{626}$  1.646,  $\gamma_{627}$  1.646,  $\gamma_{628}$  1.646,  $\gamma_{629}$  1.646,  $\gamma_{630}$  1.646,  $\gamma_{631}$  1.646,  $\gamma_{632}$  1.646,  $\gamma_{633}$  1.646,  $\gamma_{634}$  1.646,  $\gamma_{635}$  1.646,  $\gamma_{636}$  1.646,  $\gamma_{637}$  1.646,  $\gamma_{638}$  1.646,  $\gamma_{639}$  1.646,  $\gamma_{640}$  1.646,  $\gamma_{641}$  1.646,  $\gamma_{642}$

insoluble in acids, sp. gr. 4.0, isotropic,  $n$  1.94. Microchemical analysis gave  $\text{SiO}_2$  9.6,  $\text{TiO}_2$  5.0,  $\text{ZrO}_2$  29.9,  $\text{Nb}_2\text{O}_5$  1.0,  $\text{Al}_2\text{O}_3$  11.0,  $\text{Fe}_2\text{O}_3$  13.4,  $\text{FeO}$  0.8,  $\text{CaO}$  29.8,  $\text{MgO}$  0.5, =101.0, approximating to  $\text{Ca}_3\text{Zr}_2(\text{Al}_2\text{Si})\text{O}_{12}$  with Ti replacing Zr and  $\text{Fe}^{3+}$  replacing Al; this is the first record of garnet with Zr as a major constituent. The three strongest X-ray powder reflections are at 1.667Å (10), 2.539 (9), and 2.79 (8);  $a$  12.46Å. The name is in honour of the Kimzey family, long known in connection with the mineralogy of Magnet Cove. R. A. H.

ITO (TEI-ICHI) & MURAOKA (H.). *Nakaséite, an andorite-like new mineral*. Zeits. Krist., 1960, **113**, 94–98, 2 figs.

*Nakaséite* occurs intimately intergrown with tetrahedrite in gold-bearing stibnite-quartz veins of the Nakasé mine, Japan. It is monoclinic with  $a$  13.02Å,  $b$  19.18,  $c$  102.24 (24×4.26),  $\beta=90^\circ$ . Spectrographic analysis by H. Muraoka gave Ag 9.3, Cu 4.6, Pb 19.8, Fe 0.5, Zn 1.1, Sb 39.4, S 23.4,  $\text{SiO}_2$  0.2,  $\text{Cr}_2\text{O}_3$  1.2, =99.5, leading to a formula approximately  $\text{Pb}_4\text{Ag}_3\text{CuSb}_{12}\text{S}_{24}$ . The X-ray powder reflections are tabulated; strongest reflections occur at 3.300, 2.893, and 3.416Å.  $Z=24$ ; sp. gr. 5.30; a complicated lamellar crystal structure is proposed. *Nakaséite* is opaque, light greyish, and has a metallic lustre: in reflected light it is anisotropic. R. A. H.

NICKEL (E. H.), ROWLAND (J. F.), & MAXWELL (J. A.).

*The composition and crystallography of niocalite*. Canad. Min., 1958, **6**, 264–272, 5 figs., 4 tables.

This new mineral [M.A. 13–211] occurs with magnetite and apatite in a strontian calcite at Oka, Quebec, a few miles W. of Montreal, as coarse prismatic crystals up to 1 cm. long; it constitutes up to 10% of the rock. Weissenberg and precession photographs show that niocalite is monoclinic, space group  $P2/a$  or  $Pa$ ;  $a$  10.83,  $b$  10.42,  $c$  7.38Å,  $\beta$  109°40'. Crystals invariably show pseudo-orthorhombic twinning with twin plane ( $\bar{1}02$ ), either polysynthetic or as contact twins with composition plane ( $\bar{1}02$ ). Cell dimensions are compared with those of the similar minerals wöhlerite, hiortdahlite, and lāvenite. Indexed powder data are given. The better of two chemical analyses gave  $\text{CaO}$  46.96,  $\text{SiO}_2$  29.90,  $\text{Nb}_2\text{O}_5$  18.86,  $\text{Al}_2\text{O}_3$  0.16,  $\text{Fe}_2\text{O}_3$  0.54,  $\text{TiO}_2$  0.26,  $\text{P}_2\text{O}_5$  0.07,  $\text{MgO}$  0.70,  $\text{MnO}$  0.99,  $\text{Na}_2\text{O}$  0.55,  $\text{K}_2\text{O}$  0.00,  $\text{H}_2\text{O}$  0.18,  $F$  1.73,  $(-O\equiv F)$  100.17, giving the formula  $(\text{Ca}_2\text{Nb})_4\text{Si}_2(\text{O},\text{OH},\text{F})_6$ ;  $Z=4$  for a calculated density of 3.300g/cm<sup>3</sup>; measured sp. gr. 3.32. Niocalite has a clear lemon-yellow colour, vitreous lustre, no cleavage, conchoidal fracture,  $H.\approx 6$ ; is biaxial,  $\alpha$  1.701,  $\beta$  1.714,  $\gamma$  1.720,  $2V_\alpha$  56°,  $\alpha||b$ ,  $\gamma:c$  12°. R. B. F.

AOKI (K.) & MATSUMOTO (H.). *On kaersutite from the Iki Island, Nagasaki Prefecture*. Journ. Japanese Assoc. Min. Petr. & Econ. Geol., 1959, **43**, 248–253, 2 tables, (Japanese and English summaries).

Kaersutite is found in trachybasalt, trachyandesite, trachyte and alkali rhyolite of the Iki Island, Nagasaki Pref., Japan. Kaersutite-bearing rocks are studied chemically. Three chemical analyses and optical data of kaersutites are presented. They are as follows (analyst Matsumoto):

|    | $\text{SiO}_2$ | $\text{TiO}_2$ | $\text{Al}_2\text{O}_3$ | $\text{Fe}_2\text{O}_3$ | $\text{FeO}$ | $\text{MnO}$ | $\text{MgO}$ | $\text{CaO}$ | $\text{Na}_2\text{O}$ |
|----|----------------|----------------|-------------------------|-------------------------|--------------|--------------|--------------|--------------|-----------------------|
| 1. | 40.36          | 7.09           | 13.78                   | 3.93                    | 7.91         | 0.14         | 11.08        | 10.82        | 2.78                  |
| 2. | 39.15          | 7.55           | 13.67                   | 7.11                    | 5.05         | 0.14         | 11.29        | 11.65        | 3.41                  |
| 3. | 39.68          | 7.12           | 12.81                   | 4.04                    | 8.79         | 0.16         | 11.22        | 11.06        | 3.37                  |

|    | $\text{H}_2\text{O}+$ | $\text{H}_2\text{O}-$ | $F$  | less O<br>for F | Total  | $\alpha$ | $\beta$     | $\gamma$ | $-2V_\alpha$ |
|----|-----------------------|-----------------------|------|-----------------|--------|----------|-------------|----------|--------------|
| 1. | 0.79                  | 0.26                  | 0.37 | 0.16            | 100.49 | 1.688    | 1.708       | 1.720    | 78°          |
| 2. | 0.45                  | 0.10                  | 0.31 | 0.13            | 100.25 | 1.689    | 1.709–1.741 | 1.772    | 80–77°       |
| 3. | 0.78                  | 0.15                  | 0.33 | 0.14            | 100.41 | 1.685    | 1.710–1.718 | 1.736    | 74–66°       |

The writers proposed the name *oxykaersutite* for variety, which shows high ratio of  $\text{Fe}_2\text{O}_3/\text{FeO}$  and refractive indices with strong pleochroism. M. S.

HUTTON (C. OSBORNE). *Papagoite, a new copper-bearing mineral from Ajo, Arizona*. Amer. Min., 1960, **599–611**, 4 figs.

*Papagoite*,  $4[\text{CaCuAl}(\text{SiO}_3)_2(\text{OH})_3]$ , is named after an Indian tribe which inhabited the area in which Ajo is situated. The mineral is monoclinic; crystals are slightly flattened on {001} with dominant forms  $c$  {001},  $g$  {401},  $m$  {110}; space group  $Cm$ ,  $C2$ , or  $C2/m$ ;  $a$  12.91,  $b$  11.1,  $c$  4.69Å,  $\beta$  100°38'. Strongest lines in the X-ray powder pattern are 2.874 (10), 4.29 (9), 2.795 (8), and 3.44Å. The mineral is cerulean blue with absorption  $\gamma>\beta>\alpha$ ;  $\alpha$  1.607,  $\beta$  1.641,  $\gamma$  1.672,  $\gamma-\alpha$  0.065,  $2V_\alpha$  78°; sp. gr. 3.4; cleavage  $||\{100\}$ . Analysis gives  $\text{SiO}_2$  33.60,  $\text{Al}_2\text{O}_3$  17.1,  $\text{MgO}$  0.09,  $\text{TiO}_2$  0.26,  $\text{FeO}$  0.27,  $\text{MnO}$  0.10,  $\text{CuO}$  20.0,  $\text{CaO}$  17.02,  $\text{H}_2\text{O}+$  9.01,  $\text{H}_2\text{O}-$  0.04, =99.70. A. C.

HAUSEN (D. M.). *Schoderite, a new phosphorvanadate mineral from Nevada*. Bull. Geol. Soc. Amer., **71**, 1883 (abstract).

A new mineral, *schoderite* ( $2\text{Al}_2\text{O}_3 \cdot \text{V}_2\text{O}_5 \cdot \text{P}_2\text{O}_5 \cdot 12\text{H}_2\text{O}$ ), occurs as yellowish orange microcrystalline coatings associated with wavellite and an unidentified white aluminous phosphate mineral along fractures in phosphatic cherts at Eureka, Nevada. It is monoclinic, and forms bladed tabular crystals on (010), elongated on  $c$ ;  $2V_\gamma$  60° (calc.),  $\alpha$  1.548,  $\beta$  1.548,  $\gamma$  1.506;  $\beta=b$ . The X-ray powder pattern shows strongest lines 7.9 (10), 11.1 (5), 15.8 (4), and 9.6Å (2). In dry atmosphere at room temperature it is converted to a lower hydrate, *metaschoderite* ( $2\text{Al}_2\text{O}_3 \cdot \text{V}_2\text{O}_5 \cdot \text{P}_2\text{O}_5 \cdot 3\text{H}_2\text{O}$ ); the latter has  $\alpha$  1.598,  $\beta$  1.604,  $\gamma$  1.626;  $2V_\alpha$  73° (r.i. indicate a +2V),  $\gamma=b$ . The name is in honour of William P. Schoder, research chemist, Union Carbide Nuclear Company. R. A.

BARIAND (P.) & HERPIN (P.). *Un arséniate de calcium et de magnésium, isomorphe de la  $\beta$ -rosélite*. Bull. Soc. Min. Crist., 1960, **83**, 118–121, 1 fig.

very small pale green crystals occurring with conichalcite, turgite, aragonite, and dolomite in mineralized joints of porphyritic diorite of the Cu, Ni, and Co mine of Talmessi, in west of Anarak, central Persia, are recognised as a mineral isomorphous with  $\beta$ -roselite [M.A. 13-8]. Named after the locality of its discovery, *talmessite* has a unit cell with  $a$  5.89,  $b$  7.69,  $c$  5.56 Å,  $\alpha$  112°38',  $\beta$  70°49',  $\gamma$  99°25';  $D$  3.421 g/cm<sup>3</sup>; strongest X-ray powder reflections occur at 3.10 (10), 3.07 (10), 2.77 (9) Å; the fully indexed pattern is tabulated. Optically it is biaxial negative with  $\alpha$  1.680,  $\gamma$  1.69; the thermogravimetric curve shows loss of water at about 450°C. An analysis on 300 mg gave As<sub>2</sub>O<sub>5</sub> 47.7, CaO 29.5, MgO 7.5, BaO 3.2, NiO 0.8,  $\gamma$  6.70, [=95.4], leading, by analogy with roselite, to the formula Ca<sub>12</sub>(Mg,Ba,Ni)H<sub>2</sub>(AsO<sub>4</sub>)<sub>2</sub>(OH)<sub>2</sub>. A new analysis is desirable.

R. A. H.

FERBRIDGE (W. F.), STAATZ (M. H.), MEYROWITZ (R.), & POMMER (A. M.). *Weeksite, a new uranium silicate from the Thomas Range, Juab County, Utah*. Amer. Min., 1960, **45**, 39-52, 1 fig.

*Weeksite*, K<sub>2</sub>(UO<sub>2</sub>)<sub>2</sub>(Si<sub>2</sub>O<sub>5</sub>)<sub>3</sub>.4H<sub>2</sub>O, is found on the east of the Thomas Range and is named in honour of Dr. D. Weeks. *Weeksite* is biaxial negative 2V 60°;  $\alpha$  1.596 (colourless),  $\beta$  1.603 (pale yellow green),  $\gamma$  1.606 (yellow green); sp. gr. about 4.1; orthorhombic, pseudotetragonal; space group  $Pnnb-D_{2h}^6$ ; the unit cell,  $a$  26,  $b$  35.88,  $c$  14.20 Å,  $a:b:c=0.3974:1:0.3958$  contains 4 units, and the strongest lines of the X-ray powder pattern are 7.11 (10), 5.57 (9), 8.98 (8), 3.55 (7), 3.30 (7), 2.76 (6). Chemical analysis gave K<sub>2</sub>O 5.5, Na<sub>2</sub>O 0.7, BaO 1.1, UO<sub>3</sub> 51.5, SiO<sub>2</sub> 33.6, H<sub>2</sub>O 6.6, Al<sub>2</sub>O<sub>3</sub> 0.6, CO<sub>2</sub> 101.3. X-ray powder data are given also for a synthetic sodium analogue of *weeksite*.

A. C. H.

CRISTMAN (R. A.), BROCK (M. R.), PEARSON (R. C.), & SINGEWALD (Q. D.). *Geology and thorium deposits of the Wet Mountains, Colorado; a progress report*. Bull. U.S. Geol. Survey, 1959, **1072-H**, 491-535.

A complex series of paragneisses is cut by an albite-quartz stock and by numerous N.W.-trending dikes, veins,

and fractures. Besides iron oxides and local thorium minerals many veins contain abundant carbonates, baryte, quartz, and sparse sulphides. The thorium is mostly disseminated and indistinguishable but in places occurs as a massive, brownish red mineral resistant to weathering, with smooth fracture, high lustre greasy to vitreous,  $H \approx 4.5$ , sp. gr.  $\approx 5.1$ , anisotropic, refr. ind. 1.73-1.77. It shows a low endothermal peak at 220°C and a sharp exothermal peak at 840°C. Chemical analysis, by H. Levine, of material from Pine Tree Claim, Custer Co., Colorado, gave SiO<sub>2</sub> 21.22, Fe<sub>2</sub>O<sub>3</sub> 13.64, ThO<sub>2</sub> 46.02, rare earths 5.06, H<sub>2</sub>O+ 8.56, H<sub>2</sub>O- 2.66, CuO 1.64, BaO 0.31, PbO 0.08, P<sub>2</sub>O<sub>5</sub> 0.49, =99.68. Spectrographic data, by Catherine Valentine, are given. The mineral is similar to thorogummite [M.A. 12-439] and to ferrothorite, and is referred to as a *hydrated thorite-like mineral*.

K. S.

[RUDNEVA (A. V.) Руднева (А. В.) Новые минералы титанистых шлаков [New minerals of titanium-rich slags]. Труды Пятого Сов. Эксп. Техн. Мин. Петр. [Trans. Fifth Conf. Exper. Techn. Min. Petr.], Изд. Акад. Наук СССР [Publ. Acad. Sci. U.S.S.R.], 1958, 285-298, 7 figs.

The new minerals are—*Imanite* (after the initial letters of Institut Metallurgii Akademii Nauk); 3CaO.Ti<sub>2</sub>O<sub>3</sub>.3SiO<sub>2</sub> (based on an approximate analysis of slag); cubic or rhombohedral crystals, orange-brown, isotropic,  $n$  1.905 (yellow light), no cleavage; *Baikovite* (after A. A. Baikov), platy and skeletal cross-shaped crystals,  $\beta$  1.807,  $\alpha$  and  $\gamma$  not determined, brown colour, pleochroism from yellow-brown to dark brown, straight extinction, birefringence not above 0.01; chemical analysis of the slag gave SiO<sub>2</sub> 10.72, TiO<sub>2</sub> 31.17, Ti<sub>2</sub>O<sub>3</sub> 16.68, Al<sub>2</sub>O<sub>3</sub> 8.52, CaO 20.09, MgO 6.80, =93.98. This slag is composed of 29.3% titanaugite, 45.2% perovskite and 25.6% baikovite (MgO.Ti<sub>2</sub>O<sub>3</sub>). Five minerals belonging to the group of anosovite are also described, namely, (1) titanium-three-anosovite, (2) titanium-four-anosovite, (3) magnesium-anosovite, (4) aluminium-anosovite, and (5) ferruginous-anosovite. The solid solutions 2MgO.TiO<sub>2</sub>-2FeO<sub>2</sub>TiO<sub>2</sub> are discussed. [A.M. 44-907]

S. I. T.

## PHYSICAL PROPERTIES OF MINERALS

FRANKE (J. D.). *Physics of water and ice*. Nature, 1958, **181**, 380-382.

Report of a discussion held at the Royal Society on 14, 1957. [M.A. 14-176]

C. H. K.

FRER (R. M.) & REES (L. V. C.). *Energies of activation for self-diffusion of alkali metal ions in analcite*. Nature, 1960, **187**, 768-769, 1 fig.

M. J. LE B.

GOOD (R. J.), GIRIFALCO (L. A.), & KRAUS (G.). *A theory for estimation of interfacial energies. II. Application to surface thermodynamics of teflon and graphite*. Journ. Phys. Chem., 1958, **62**, 1418-1421.

Using a previously published theory of interfacial energy, and heats of immersion in organic liquids, the basal plane of graphite is calculated to have a surface energy of 119 ergs/cm<sup>2</sup>, a free energy of 70 ergs/cm<sup>2</sup>, and an entropy of 0.16 erg/cm<sup>2</sup> °C.

W. T. H.

HACKERMAN (N.) & HALL (A. C.). *The adsorption of water vapor on quartz and calcite*. Journ. Phys. Chem., 1958, **62**, 1212-1214, 6 figs.

Adsorption isotherms at 15° and 25°C allow calculations of two-dimensional spreading pressure of the adsorbed film, heat of adsorption, and energy of immersion. W. T. H.

BARRER (R. M.) & STUART (W. I.). *Ion exchange and the thermodynamics of intracrystalline sorption. I. Energetics of occlusion of argon and nitrogen by faujasite-type crystals*. Proc. Roy. Soc. London, 1959, **249A**, 464-483. *II. Entropy of occlusion of argon and nitrogen by faujasite-type crystals*. Ibid., 484-497.

The study of the occlusion of A and of N<sub>2</sub> in a variety of ion-exchanged, synthetic, faujasite-type crystals between 173° and 273°K has enabled the contributions of dispersion, polarization, and quadrupole interactions to the energy of the sorption process to be distinguished. Entropies of occlusion are evaluated, and analysed in terms of statistical thermodynamics. D. McK.

GAINES (G. L., Jr.) & RUTKOWSKI (C. P.). *The adsorption of gases on ion-exchanged mica. I. Argon and krypton isotherms and BET surface area measurements*. Journ. Phys. Chem., 1958, **62**, 1521-1525, 6 figs. *II. Thermodynamics of rare gas adsorption*. Ibid., 1526-1530, 10 figs.

Adsorption of rare gases to the basal surface of muscovite ion-exchanged with Ba or Cs [M.A. 14-157] are interpreted in the terms of the geometrical fit of the ions on the surface. W. T. H.

WEI (Y.-K.) & BERNSTEIN (R. B.). *Deuterium exchange between water and boehmite ( $\alpha$ -alumina monohydrate). Activation energy for proton diffusion in boehmite*. Journ. Phys. Chem., 1959, **63**, 738-741, 2 figs.

The activation energy for proton diffusion is 12.9 kcal/mole, but oxygen diffusion is very much slower. W. T. H.

MAKRIDES (A. C.) & HACKERMAN (N.). *Heats of immersion. I. The system silica-water*. Journ. Phys. Chem., 1959, **63**, 593-598, 2 figs.

After baking at temperatures below 300°C, the heat of wetting at room temperature of powdered quartz consists mainly of heat of adsorption, but baking at higher temperatures also causes dehydroxylation of the quartz surface. W. T. H.

WADE (W. H.) & HACKERMAN (N.). *Heats of immersion. II. Calcite and kaolinite—the effect of pre-treatment*. Journ. Phys. Chem., 1959, **63**, 1639-1641, 1 fig.

Measured heats of immersion are  $660 \pm 5$  ergs/cm<sup>2</sup> for

kaolinite (with interlayer water removed at 300°C), 1000 ergs/cm<sup>2</sup> for metakaolin, and  $762 \pm 2$  ergs/cm<sup>2</sup> for calcite. W. T. H.

FROST (M. J.). *Magnetic susceptibility of garnet*. Min. Mag., 1960, **32**, 573-576.

The mass susceptibility of 23 analysed or partially analysed garnets has been measured by means of a calibrated Frantz isodynamic magnetic separator. Assuming that the mass susceptibilities of grossular and pyrope are zero, the mass susceptibilities of the end-member compositions extrapolated from the observed values are estimated as: almandine  $68 \pm 2$ , spessartine  $81 \pm 3$ , and andradite  $49 \pm 3$  e.m.u.  $\times 10^{-6}$ . R. A. H.

PICKART (S. J.) & TURNOCK (A. C.). *Magnetic properties of solid solutions of Fe<sub>3</sub>O<sub>4</sub> and FeAl<sub>2</sub>O<sub>4</sub>*. Journ. Phys. Chem. Solids, 1959, **10**, 242-244, 3 figs.

Magnetic properties of the magnetite-hercynite series are such as to indicate that for each Al<sup>3+</sup> substituted in magnetite an Fe<sup>2+</sup> ion is transferred from the B to the A site of the spinel structure, the structure changing continuously from the inverse to the normal spinel arrangement. R. A. H.

KAWAI (N.), ITO (H.), YASKAWA (K.), & KUME (K.). *Remanent magnetism of dehydrated iron hydroxides in sedimentary and metamorphic rocks*. Mem. Coll. Sci. Univ. Kyoto, ser. B, 1959, **26**, 235-239, 4 figs., 1 table.

When goethite and lepidocrocite were dehydrated under pressure (2550 atm., 350° to 400°C) in a magnetic field of specific direction, the resulting  $\alpha$ - and  $\gamma$ -hematites were magnetized not along the magnetic field but approximately perpendicular to the field. The results may be useful in the interpretation of the remanent magnetism of sedimentary and metamorphic rocks. M. S. J.

POWELL (D. W.). *Stress-dependent magnetization in some quartz-dolerites*. Nature, 1960, **187**, 225, 1 fig.

M. J. LE B.

FULLER (M. D.). *Anisotropy of susceptibility and the natural remanent magnetization of some Welsh slates*. Nature, 1960, **186**, 791-792.

D. McK.

CLEGG (J. A.), RADAKRISHNAMURTY (C.), & SAHASRABUDRI (P. W.). *Remanent magnetism of the Rajmahal Trachyte of north-eastern India*. Nature, 1958, **181**, 830-831, 2 figs.

C. H. B.

WARGO (J. G.). *Magnetic susceptibility and fusion data for some volcanic rocks from south-western New Mexico*. Bull. Geol. Soc. America, 1960, **71**, 87-92, 4 figs.

Chemical analyses are reported for a brown tuff breccia

ryhyolite, and reddish welded tuff together with partial  
lyses of a vitric crystal tuff and a vitrophyre, all from  
'Schoolhouse Mountain area' in Grant County, New  
Mexico. The maximum, minimum, and mean magnetic  
susceptibilities of these rocks, as measured in the field, are  
shown in a graph. The refr. ind. of the glasses obtained by  
fusion of these rocks under an electric arc are plotted  
against the separately determined  $\text{SiO}_2$  contents for 35  
samples.

A. P.

ALL (C.) & IRVING (E.). *Palaeomagnetism in Antarctica*.  
*Nature*, 1960, **185**, 834-5.

D. McK.

WATER (H. A.) & ELLICKSON (R. T.). *Remanent mag-*  
*netization of ancient bricks*. *Nature*, 1958, **181**, 404.

C. H. K.

JUN (E.), HARTMANN (P.), STAUB (H. H.), HAFNER (St.),  
& LAVES (F.). *Magnetische Kernresonanz zur Beobach-*  
*tung des Al/Si-Ordnungs/Unordnungsgrades in einigen*  
*Feldspäten*. *Zeits. Krist.*, 1960, **113**, 65-76, 5 figs.

The nuclear magnetic resonance technique was used to  
study electric quadrupole interactions of  $^{27}\text{Al}$  and  $^{23}\text{Na}$   
in the crystalline fields of some feldspars. Albite and  
microcline were held at around  $1050^\circ\text{C}$  for periods of weeks  
and yielded magnetic resonance spectra closely resembling  
that of sanidine. This change is interpreted as due to a  
transformation of an ordered Al/Si distribution to a dis-  
ordered one in these two minerals.

R. A. H.

PROS (P.). *Étude de la mobilité de l'eau et des cations dans*  
*quelques zéolites par relaxation diélectrique et résonance*  
*magnétique nucléaire*. *Bull. Soc. franç. Min. Crist.*,  
1960, **83**, 85-112, 28 figs.

Dielectric absorption and proton nuclear magnetic  
resonance measurements are reported for chabazite and  
hectorite and other zeolites. The magnetic studies show  
a resonance diagram with two fine lines whose separation  
varies with the orientation of the crystal and its water  
content; the variation in height of the line with crystal  
orientation and with temperature ( $150$ – $300^\circ\text{K}$ ) have also  
been studied. Two areas of dielectric absorption have been  
recognized in chabazite, one is attributed to the mobility  
of the  $\text{Ca}^{2+}$  ions and the other at a lower temperature to the  
rotation of the water molecules.

R. A. H.

MIYAMA (R.) & KAWAI (S.). *Dielectric phenomena of*  
*smoky quartz, natural and X- and  $\gamma$ -ray irradiated*.  
*Min. Journ. [Japan]*, 1960, **3**, 19-29, 8 figs., 2 tables.

Dielectric dispersion of natural smoky quartz is observed  
in the audio-frequency region at about  $400^\circ\text{C}$ . The  
enthalpy of activation for the dielectric relaxation was

about 50 kcal/mole in contrast with a value of about 20  
kcal/mole for natural colourless quartz. By thermal  
bleaching, the enthalpy of activation falls to the value for  
natural colourless quartz. Exposed to X-rays, the bleached  
quartz coloured again and the value of activation enthalpy  
recovered, and on exposure to  $\gamma$ -radiation of about  $10^5$  to  
 $10^7$  r. in total dose, coloration was also attained, but the  
effect was different from that by X-rays. A linear relation  
was found between the energies of activation and the  
logarithms of the total doses of irradiation. Probable  
molecular mechanisms responsible for these dielectric  
phenomena are proposed. The role of water molecules  
trapped in the structure is discussed.

M. S. J.

JONA (F.). *Preparation and dielectric properties of synthetic*  
*boracite-like compounds*. *Journ. Phys. Chem.*, 1959,  
**63**, 1750-1752, 3 figs.

The dielectric constant of natural and synthetic boracite  
rises slowly from 7.5 at room temperature and jumps  
suddenly at the inversion temperature of  $265^\circ\text{C}$ . Synthetic  
Mg-, Ni-, Zn-, and Cd-boracites were also measured.

W. T. H.

NEUHAUS (A.). *Über die Ionenfarben der Kristalle und*  
*Minerale am Beispiel der Chromfärbungen*. *Zeits.*  
*Krist.*, 1960, **113**, 195-233, 6 figs.

From a study of chromiferous minerals, including spinel,  
pyrope garnet, chrysoberyl, uvarovite, smaragdite, and  
fuchsite and various synthetic crystals, it is concluded that  
 $\text{Cr}^{3+}$  enters exclusively into octahedral lattice positions.  
The colour change from red to violet to green in  $\text{Cr}^{3+}$ -  
bearing crystals depends on specific  $\lambda$ -shifts of the charac-  
teristic maxima of absorption. Such  $\lambda$ -shifts are related to  
expansions or contractions of the Cr-bearing colour com-  
plexes produced by various causes including the effects of  
contra-polarisation by neighbouring cations, diadochic  
exchanges of the central ions, exchanges among the linking  
elements or groups, and heating or cooling. [M.A. **14**-118]

R. A. H.

DOLEJŠÍ (J.), KANTÜREK (J.), BOHUN (J.), & TRNKA (J.).  
*Die Lumineszenz, Verfärbung und Exoelektronenemission*  
*von nach verschiedenen Arten gefärbten  $\text{CaF}_2$ -Kristallen*.  
*Czechosl. Journ. Phys., Praha*, **8**, 1958, 548-556, 12  
figs. (In German.)

The results are given of a complex study of optical and  
electrical effects in natural and artificial crystals of  $\text{CaF}_2$ ,  
from various sources, which had been coloured photo-  
chemically, additively or simultaneously. The authors  
specially examined absorption at constant and at uniformly  
rising temperature (thermoabsorption), integral lumines-  
cence and its spectroanalysis, and exoelectronemission.

J. N.

GRAY (I.) & MILLMAN (A. P.). *Spectral reflectivity of ore minerals*. Nature, 1960, **187**, 282-284, 3 figs.

Standard absolute values of reflectivity in ore microscopy are given, using the natural surface of pure mercury under a glass cover stop, and a polished basal section of quartz as standards (computed white-light reflectivities are 69.3% and 45% respectively). A photo-conductive cadmium sulphide cell is described for the measurement of reflectivity at various wave-lengths of incident light.

M. J. LE B.

VICKERY (R. C.) & SEDLACEK (R.). *Absorption spectra of rare earths in glasses*. Nature, 1958, **181**, 39-40, 2 figs.

C. H. K.

CAILLÈRE (S.) & POBEGUIN (TH.). *Contribution à l'étude des carbonates simple anhydres*. Bull. Soc. franç. Min. Crist., 1960, **83**, 36-41, 6 figs.

The structure of the metallic ion, in particular its diameter, plays an important role in the position and displacement of infrared absorption bands in the carbonates. The electronic configuration of the cation appears to control the temperature of dissociation of these minerals. Infra-red spectra, d.t.a. curves in air and in argon, and thermogravimetric curves in air and nitrogen are figured for calcite, chalybite, rhodochrosite, smithsonite, sphaerocobaltite, and magnesite, together with infra-red spectra only for aragonite, strontianite, cerussite, and witherite.

R. A. H.

FRIPIAT (J. J.) & TOUSSAINT (F.). *Predehydroxylation state of kaolinite*. Nature, 1960, **186**, 627-628.

The infra-red spectrum of kaolinite shows a hydroxyl vibration band with transmission minima at 3700, 3663, and 3627  $\text{cm}^{-1}$ , which merge into a single band at 3680  $\text{cm}^{-1}$  on heating to 400°C, the change being reversed on cooling; water loss is however very small below 450°C, and a predehydroxylation structural state may be postulated. On cooling from this state resolution into three components still occurs, but frequencies are higher by 10-20  $\text{cm}^{-1}$ .

D. McK.

SERRATOSA (JOSÉ M.) & BRADLEY (W. F.). *Infra-red absorption of OH bonds in micas*. Nature, 1958, **181**, 111, 1 fig.

At normal incidence, biotites show no absorption in the frequencies associated with the O-H bond. As the angle of incidence is increased, absorption at  $3.710 \times 10^3 \text{ cm}^{-1}$  increases regularly. Muscovites show strong absorption at  $3.620 \pm 20 \text{ cm}^{-1}$  for normal incidence and this is not markedly sensitive to moderate changes in the angle of incidence. The difference in behaviour can be correlated with differences in the orientations of the O-H bonds in the two micas. The lesser frequency in muscovite may be evidence of some hydrogen bonding. The absorption

spectra of lepidolites show that they are intergrowths of biotite and a muscovite.

C. H. K.

TARTE (P.). *Infra-red spectrum of garnets*. Nature, 1960, **186**, 234.

The infra-red absorption spectrum of garnet down to 280  $\text{cm}^{-1}$  is characteristic and qualitatively independent of composition, except for titanian garnets. Band frequency is directly proportional to unit cell parameter only for frequencies above 500  $\text{cm}^{-1}$ ; the lines for the pyrospinel and ugrandite series differ slightly in slope. The general pattern is progressively modified with increasing substitution of Ti for Si. [M.A. 14-201]

D. McK.

OMORI (K.) & SEKI (T.). *Infrared study of some phosphate minerals*. Journ. Japanese Assoc. Min. Petr. & Econ. Geol., 1960, **44**, 7-13, 2 figs., 5 tables, (Japanese and English summaries).

The infra-red spectra of xenotime, monazite, apatite, pyromorphite, vivianite, and autunite are studied by the Perkin-Elmer Model 21 double beam infra-red spectrophotometer. All the spectra have broad bands caused by  $\text{PO}_4$  molecules at 9 and 9.5  $\mu$ .

M. S. J.

RHODES (E.) & UBBELOHDE (A. R.). *Melting and crystal structure. Effects of thermal transformations of ionic crystals on their ultraviolet absorption*. Proc. Roy. Soc. London, 1959, **251A**, 156-171.

The low melting points of certain ionic crystals with ionic complexes of complex shape are due to the extensive formation of ionic complexes in the melt. The anion-cation distances are shorter in melts of Li, Na, and K nitrates than in the solid state. Homophase premelting in other salts is confirmed. Optical techniques, such as that described, are less influenced by smearing than are measurements of thermal parameters, and are therefore more useful for determining the local environment of individual ions.

D. McK.

ANGINO (ERNEST E.). *Pressure effects on thermoluminescence of limestone relative to geologic age*. Jour. Geophys. Res., 1959, **64**, 569-573, 3 figs.

Application of pressures up to 7720 bars was found to increase the thermoluminescence of limestones ranging in age from Cretaceous to Recent. Plots of the ratio of thermoluminescence in pressed and unpressed samples against time of application of pressure show pronounced maxima in the range 2-10 minutes. The amplitudes of these maxima in seven samples decrease with increasing geological age. The amplitude-age relationship is regular enough to suggest that it might be used as a method of determining geological age. Reproducibility of the measurements, and effects of grain size and of aragonite and dolomite content are discussed.

F. R. H.

DER (H. S., Jr.) & WEIR (C. E.). *High-pressure form of analcite and free energy change with pressure of analcite reactions*. Amer. Journ. Sci., 1960, **258**-A, 420-433.

Compressibility measurements on four different specimens of analcime at 25°C and 2000 to 10,000 atm. indicate a reversible transition at 8400 atm. in material from Golden, Colorado, and probable existence of a transition in the other at pressures above 10,000 atm. Molal volume changes per mole, defined by parameters  $u$  and  $v$  in  $\Delta V = -uP - vP^2$ , refractive indices  $n$ , densities  $D$  (before compression) and lattice constants  $a$  were measured as follows:

|                          | $u \times 10^4$ | $v \times 10^9$ | $n$   | $D$    | $a$    | $D$ (calc.) |
|--------------------------|-----------------|-----------------|-------|--------|--------|-------------|
| Golden, Colorado         | 0.843           | 27.04           | 1.485 | 2.252  | 13.712 | 2.266       |
| Simon's Bluff, N.S.      | 2.059           | 9.71            | 1.485 | 2.234  | 13.705 | 2.270       |
| Hohe Tauern Alp, Austria | 2.120           | 12.41           | 1.486 | 2.198* | 13.717 | 2.264       |
| Hohe Tauern Alp, Austria | 3.628           | 0.107           | 1.489 | 2.093† | 13.717 | 2.264       |

\* Higher after compression. † 0.033 higher after compression.

H. W.

LEDSMID (H. J.) & BOWLEY (A. E.). *Thermal conduction in mica along the planes of cleavage*. Nature, 1960, **187**, 864-865.

M. J. LE B.

LONG (H. M.). *The experimental fusion curve of iron to 96,000 atmospheres*. Journ. Geophys. Res., 1959, **64**, 653-659, 7 figs.

The fusion curve of iron has been determined to 96,000 atm. and the  $\alpha$ - $\gamma$  transition to 76,000 atm. using apparatus developed at the General Electric Research Laboratory.

The melting data are fitted by Simon's fusion equation  $P/a = (T/T_0)^c - 1$  where  $a = 75,000$  atm.,  $T_0 = 1805^\circ\text{K}$ , and  $c = 8$ . Change in electrical resistance, in absorption of latent heat of fusion, and in thermal e.m.f. characteristics were all used to detect melting. The temperature of the  $\alpha$ - $\gamma$  transformation is decreased about  $200^\circ$  at 76,000 atm. and the heat of transformation computed from the experimental data is 170-190 cal/gm atom. Extrapolation of the melting curve of iron to a pressure of  $1.4 \times 10^6$  atm., the pressure at the core-mantle boundary, indicates a temperature of at least  $2340^\circ \pm 200^\circ\text{C}$ . It is shown that alloying iron with nickel will not greatly change this estimate.

F. R. B.

MOORE (DAVID G.) & SHUMWAY (GEORGE). *Sediment thickness and physical properties: Pigeon Point Shelf, California*. Journ. Geophys. Res., 1959, **64**, 367-374, 5 figs., 1 table.

The thickness and physical properties of unconsolidated sediments on the continental shelf south of San Francisco have been studied. Sediment thicknesses were determined with an echo sounder. The wet density, porosity, compressional sound speed and absorption, static shear strength, sensitivity, and grain size distribution are given for 17 samples. The unconsolidated sediments are up to several tens of meters thick and cover two terraces cut in the bedrock which are believed to be of wave origin and of Pleistocene age.

F. R. B.

## ROCK-FORMING MINERALS AND PETROLOGY

### Rock-forming minerals

FLOR (S. R.), HEIER (K. S.), & SVERDRUP (T. L.). *Trace element variations in three generations of feldspars from the Landsverk I pegmatite, Evje, southern Norway*.

Norsk Geol. Tidsskr., 1960, **40**, 133-156, 8 figs., 2 pls. The 3 generations are: I, pink microcline associated with albite plagioclase; II, amazonite associated with cleavelandite; III, 'brick red' microcline associated with sugary albite. Triclinicity values for microclines I and II are approximately 0.80, for III 1.10. There are transitional features between I and II. Carefully prepared samples of the various minerals were examined, largely by spectrochemical methods. The concentrations of Li, Na, K, Rb, Cs, Pb, Ca, Sr, and Ba were determined, and in addition Cr, Cu, Co, Ni, V, Sn, and F for I and II. It is found that the concentrations and distribution ratios of certain of the elements reflect different conditions of formation of the feldspars of the three generations. Microcline III appears to have formed by a late secondary mineralisation. The independence of the green colour of amazonite upon the concentrations of the elements commonly found in the mineral is confirmed in the present case.

I. W. O.

GUITARD (G.), RAGUIN (E.), & SABATIER (G.). *La symétrie des feldspaths potassiques dans les gneiss et les granites des Pyrénées orientales*. Bull. Soc. franç. Min. Crist., 1960, **83**, 48-56, 5 figs.

In the regional metamorphic gneiss of the Pyrenees orthoclase is the dominant potassium feldspar in the catazone, whereas both orthoclase and microcline occur in the mesozone. In the granitized areas the catazone granites contain orthoclase and intermediate microcline, those of the mesozone have maximum microcline, and those of the epizone have orthoclase and microcline. It is concluded that the potassium feldspar always crystallizes first in the monoclinic phase: this phase is stable in the catazone. In the meso- and epizones the monoclinic phase is meta-stable and tends to become triclinic. The factors controlling this transformation are discussed.

R. A. H.

CAILLÈRE (S.) & KRAUT (F.). *Sur la répartition des feldspaths potassiques dans les roches éruptives et métamorphiques de la région d'Avallon*. Bull. Soc. franç. Min. Crist., 1960, **83**, 21-23.

In the granitic rocks near Avallon, in the Morvan district

of France, orthoclase is the predominant feldspar in the interior of the intrusive bodies whereas microcline is concentrated in their peripheral zones and in the accompanying apophyses.

R. A. H.

ROUBAULT (MARCEL). *Observations sur la composition chimique d'un cristal de microcline perthitique*. C.R. Acad. Sci., Paris, 1958, **247**, 1355-1358.

In this study of a single crystal a plate 2 cm thick,  $\parallel(001)$ , was cut up into 56 prisms with lozenge-shaped base. Each prism was optically examined, then ground for analysis; Na and K were determined by flame photometer,  $\text{Al}_2\text{O}_3$  and  $\text{SiO}_2$  by spectrograph.  $\text{SiO}_2$  ranged from 66.68 to 57.15,  $\text{Al}_2\text{O}_3$  20.65 to 18.58,  $\text{K}_2\text{O}$  12.72 to 7.62,  $\text{Na}_2\text{O}$  3.08 to 1.17%,  $\pm$  about 5% in each case. In ionic composition the Na-content varied between 99.38 and 45.52, the K-content between 306.5 and 162.23. Thus heterogeneity between the relative proportions of the alkalis was proved: the positions of the more sodic points were located in the crystals; they were not distributed concentrically as might be expected in the growth of a crystal crystallizing from a liquid. The heterogeneity is the result of metasomatism involving exchange and removal of material.

E. J. & A. S.

GLAUSER (A.) & WENK (E.). *Optische Orientierung und chemische Zusammensetzung einiger Hoch- und Tief-temperatur-Plagioklase*. Schweiz. Min. Petr. Mitt., 1960, **40**, 37-53, 2 figs.

Chemical and optical data for 17 intermediate and basic rock-forming plagioclases are given. Three analyses are new, the others have already been published by the same authors [Schweiz. Min. Petr. Mitt., 1957, **37**, 180-197]. The optical orientation is characterized by the three angles of Euler [Schweiz. Min. Petr. Mitt., 1956, **36**, 539-592]. In the range 83-91% An, it was not possible to distinguish between high temperature and low temperature optics. M. W.

SHIMAZU (M.). *Potash feldspar in some metamorphic rocks*. Journ. Japanese Assoc. Min. Petr. & Econ. Geol., 1959, **43**, 185-193, 3 figs., 5 tables, (Japanese and English summaries).

Potash feldspar from the Akka metamorphic rocks and granites are studied by optical and X-ray methods. Triclinicity in potash feldspar of these rocks shows monoclinic character, while those from other metamorphic terrains show low triclinicity. By the percentages of the albite molecule in alkali feldspar, the formation temperature of potash feldspars may be determined by Barth's method.

M. S. J.

ENGEL (A. E. J.) & ENGEL (CELESTE G.), (with analyses trace elements by A. A. CHODOS & ELISABETH GODI). *Progressive metamorphism and granitization of the metapelite, northwest Adirondack Mountains, New York: Part II: Mineralogy*. Bull. Geol. Soc. Amer., 1960, **71**, 1-58, 12 figs., 3 pls., 33 tables.

Changes in the kinds and properties of minerals in Adirondack paragneiss are related to its progressive metamorphism. Part I of this paper [M.A. **14**-309] presented chemical analyses, 50 partial chemical analyses, analyses of trace elements, and approximately 400 microanalyses of rocks. The present paper presents analytical data on the minerals from these rocks; included are complete or partial chemical analyses, spectrographic analyses, optical properties, and/or X-ray properties for 12 samples of perthitic K-feldspar, 26 of biotite, and 20 of garnet. Replicate analyses and analyses by different analysts have been used to check analytical precision. The variation of major and minor elements in each mineral and the fractionation of elements in coexisting minerals are discussed in detail, and relations of chemical composition with optical, X-ray, and density measurements are examined. A. L. A.

GOWER (J. A.). *X-ray measurement of the iron-magnesium ratio in biotites*. Amer. Journ. Sci., 1960, **258**, 298.

Credits for analyses previously published. [M.A. **14**-100] H. W.

SANDRÉA (ANDRÉ). *Etude d'une roche surmicacée du massif de Béléliéta (Algérie)*. C.R. Acad. Sci., Paris, 1960, **246**, 2776-2778.

Small masses of a rock composed of ferrous biotite, apatite, and orthoclase occur in the metamorphic limestone and diorites of Chabeth Ben Gaoutsa, notably at Béléliéta mine. Their formation appears to belong to a pneumatolytic episode later than the crystalline rocks of the region. The green mica has  $\gamma$  1.624, very deep emerald green,  $\alpha$  1.581, pale yellow,  $\gamma - \alpha$  0.043, 2V 0°. Study of absorption in visible polarized light shows maximum transparency in the zone corresponding to minimum absorption by the FeO molecule. The mica, analysed chemically and spectrographically by Patureau, has  $\text{SiO}_2$  32.1,  $\text{Al}_2\text{O}_3$  20.35,  $\text{Fe}_2\text{O}_3$  2.95, FeO 27.90, MnO 0.23, MgO 3.0, CaO 0.40,  $\text{Na}_2\text{O}$  0.06,  $\text{K}_2\text{O}$  8.03,  $\text{TiO}_2$  0.21,  $\text{P}_2\text{O}_5$  0.0,  $\text{H}_2\text{O} + 3.95$ , = 99.77. E. J.

BANNO (S.). *Notes on rock-forming minerals (12). Findings of paragonite from the Bessi District, Shikoku, and its paragenesis*. Journ. Geol. Soc., Japan, 1960, **123**-130, 6 figs., 1 table.

Chemical, optical, and X-ray powder data are given for paragonite separated from kyanite-amphibolite, garnet-amphibolite, and hornblende-schist in the Bessi District.

oku, Japan. Chemical analysis by H. Haramura is as follows:  $\text{SiO}_2$  46.20,  $\text{Al}_2\text{O}_3$  39.58,  $\text{Fe}_2\text{O}_3$  0.79,  $\text{FeO}$  0.3,  $\text{CaO}$  0.14,  $\text{CaO} < 0.1$ ,  $\text{Na}_2\text{O}$  6.76,  $\text{K}_2\text{O}$  0.62,  $\text{H}_2\text{O} +$  4.81,  $\text{H}_2\text{O} -$  0.10,  $\text{TiO}_2$  0.30,  $\text{P}_2\text{O}_5$  0.16,  $\text{MnO}$   $< 0.02$ , = 99.88. Optical properties are  $\alpha$  1.577,  $\beta$  1.605,  $\gamma$  1.611,  $2V_\alpha$   $1^\circ$ .

M. S. J.

I (Y.). *Actinolite in the eastern part of the Kanto mountains*. Journ. Japanese Assoc. Min. Petr. & Econ. Geol., 1959, **43**, 179–184, 1 fig., 3 tables, (Japanese and English summaries).

The glaucophanitic regional metamorphic terrain in the eastern part of the Kanto Mts. in central Japan can be divided into two zones which are characterized by pale green actinolite (I) and greenish blue actinolite (II) respectively. The latter is only found in the highest grade of the terrain and the former is distributed in the non-metamorphosed schists, phyllites, and weakly metamorphosed Mesozoic formations. Chemical and optical data of two actinolites are as follows (analyses by Y. Seki and C. Kato):

| $\text{SiO}_2$ | $\text{Al}_2\text{O}_3$ | $\text{Fe}_2\text{O}_3$ | $\text{FeO}$ | $\text{MgO}$ | $\text{CaO}$ | $\text{Na}_2\text{O}$ | $\text{K}_2\text{O}$ | $\text{H}_2\text{O} +$ |
|----------------|-------------------------|-------------------------|--------------|--------------|--------------|-----------------------|----------------------|------------------------|
| 56.06          | 2.14                    | 2.22                    | 8.97         | 16.11        | 10.28        | 1.36                  | nil                  | 2.42                   |
| 50.55          | 6.51                    | 5.40                    | 11.58        | 10.72        | 9.77         | 1.46                  | 0.18                 | 2.89                   |

| $\text{H}_2\text{O} -$ | $\text{MnO}$ | Total | $\alpha$ | $\beta$ | $\gamma$ | $2V$       | $\gamma : c$ |
|------------------------|--------------|-------|----------|---------|----------|------------|--------------|
| 0.17                   | 0.23         | 99.96 | 1.626    | 1.634   | 1.640    | $78^\circ$ | $24^\circ$   |
| 0.31                   | 0.32         | 99.69 | 1.648    | 1.661   | 1.669    | $65^\circ$ | $30^\circ$   |

A. 14–428].

M. S. J.

SON (ALLAN F.). *Co-existing pyroxenes: some causes of variation and anomalies in the optically derived compositional tie-lines, with particular reference to charnockitic rocks*. Geol. Mag., 1960, **97**, 1–17.

Published optical and, where available, chemical data for co-existing ortho- and clino-pyroxenes from metamorphic rocks are assembled, together with new optical data for twenty-eight Australian pyroxene pairs. The compositions are obtained from the optical properties, and possible causes of the discrepancies between these and the chemical analyses are discussed. From the direction of the tie-line for each pair of pyroxenes the intersection with the Ca–Mg–Fe–Fe, edge of the composition triangle is obtained. An analysis of these positions of intersection leads to the conclusion that, despite the discrepancies between chemically and optically derived tie-lines, the optically derived tie-trends for different metamorphic rocks show significant differences from one another and from those for plutonic rocks. The intersection points are correlated with the stability or otherwise of the mineral assemblage and with the thermal histories of the rocks. [M.A. **13**–351, 47, 350, 417]

M. G. B.

AMOTO (T.). *Zircons in volcanic rocks—zircons in andesite from Kyushu*. Journ. Japanese Assoc. Min. Petr. & Econ. Geol., 1959, **43**, 282–296, 7 figs., 1 pl., 4 tables, (in Japanese).

Statistical study on colour, crystal size, elongation ratio, crystal habit, tracht, &c., of zircon crystals separated from andesitic rocks in Kyushu District, Japan. Some genetic interpretations are also presented.

M. S. J.

### Petrography: general and regional

STEVENS (ROLLIN E.), & OTHERS. *Second report on a cooperative investigation of the composition of two silicate rocks*. Bull. U.S. Geol. Survey, 1960, **1113**, 1–126. Price 40 cents.

This work includes the following papers:—

FLEISCHER (MICHAEL). *Introduction*. [Bull. U.S. Geol. Survey, 1951, **980**; M.A. **12**–264]. Pp. 1–2.

STEVENS (ROLLIN E.) & NILES (WILLIAM W.). *Chemical analyses of the granite and the diabase*. (Pp. 3–43)

New analyses (27 for G–1 and 31 for W–1) from laboratories throughout the world are compared with each other and with the results of the reconnaissance survey published in Bull. U.S. Geol. Survey, 1951, **980**. Conventional methods of rock analysis are examined for sources of error to account for the wide divergence of results. The variations in  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{Fe}_2\text{O}_3$ , and  $\text{FeO}$  are shown on S-curves of distribution, for comparison these are printed adjacent to similar curves representing old [Bull. **980**] analyses. Although the range of results for each constituent is large, arithmetic means and medians of all and of preferred values, for both the new and the old analyses, show general agreement with published results by competent analysts and with results by methods other than conventional. Low results for  $\text{SiO}_2$  are obtained in most laboratories by the techniques and procedures in present use. Results for  $\text{Al}_2\text{O}_3$  and for  $\text{Fe}_2\text{O}_3$  show lack of precision and apparent positive bias. Results for  $\text{K}_2\text{O}$  tend to be low. Results for other constituents are in better agreement and seem to be more reliable. [M.A. **12**–264]

STEVENS (ROLLIN E.) & CHODOS (ARTHUR A.). *Special study of the silica content of G–1 and W–1 by combined wet chemical and spectrographic methods*. (Pp. 45–56)

Values of 72.70 and 52.77%  $\text{SiO}_2$  for G–1 and W–1 (moisture free), respectively, were obtained by collecting and weighing the silica and by determining spectrographically and by wet chemical methods the corrections required because of impurities in the separated silica, losses of silica in the chemical processes, and gains of silica from reagents and filter paper. The values quoted are 0.2 to 0.3% higher than the consensus mean of analyses made in the

usual way and add to the evidence that complete recovery of silica is not usually attained in the routine analytical procedures for silica in general use.

FILBY (ROYSTON H.) & LEININGER (R. K.). *Spectrographic determinations of the major constituents of granite G-1 and diabase W-1*. (Pp. 57-82)

Values based on spectrographic analyses recommended for the major constituents of G-1 and W-1, respectively, are  $\text{SiO}_2$  72.65, 52.64;  $\text{Al}_2\text{O}_3$  14.23, 15.00; total iron as  $\text{Fe}_2\text{O}_3$  1.96, 11.10;  $\text{MgO}$  0.39, 6.61;  $\text{CaO}$  1.36, 10.94;  $\text{Na}_2\text{O}$  3.32, 2.07;  $\text{K}_2\text{O}$  5.43, 0.64;  $\text{TiO}_2$  0.24, 1.08;  $\text{MnO}$  0.027, 0.18. These  $\text{Al}_2\text{O}_3$ ,  $\text{CaO}$ ,  $\text{MgO}$ , and  $\text{K}_2\text{O}$  values have been corrected for trace elements which interfere with normal chemical determinations.

AHRENS (L. H.) & FLEISCHER (MICHAEL). *Report on trace constituents in granite G-1 and diabase W-1*. (Pp. 83-111)

All available data regarding trace constituents, based on chemical-colorimetric, isotope-dilution, and neutron-activation methods, and on spectrographic procedures, are tabulated for 39 elements.

FLANAGAN (FRANCIS J.). *The lead content of G-1*. (Pp. 113-121)

The best estimate of the lead content, based on replicate spectrographic and wet chemical analyses, is 48.9 p.p.m.

K. S.

CHAYES (FELIX). *Occurrence of normative sodium metasilicate in Washington's tables*. Bull. Geol. Soc. America, 1960, **71**, 503-504.

TUTTLE (O. F.). *Occurrence of normative sodium metasilicate in Washington's tables: A reply*. Op. cit., **71**, 505-506.

A criticism and a reply to criticism of pages 88 and 89 of Geological Society of America Memoir 74 (Tuttle, O. F., & Bowen, N. L.). [M.A. **14**-89, **15**-62]

A. L. A.

SZÁDECZKY-KARDOSS (E.), PANTÓ (G.), & FUX-SZÉKY (V.). *A preliminary proposition for developing a uniform nomenclature of igneous rocks*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **13**, 287-292, 2 figs.

R. A. H.

SZÁDECZKY-KARDOSS (E.). *A genetical system of igneous rocks*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **13**, 260-274, 1 fig.

In consideration of the importance of volatiles the following igneous rock groups are recognised. (1) Orthomagmatites—high temperature crystallization, low volatile content, derived from deep seated basic melts. (2) Hemi-

orthomagmatites—medium temperature, higher volatile content (mainly alkaline). (3) Hypomagmatites—late crystallization interval ending at very low temperature, high volatile content. (4) Metamagmatites—igneous rocks with secondary low temperature replacements by volatile bearing minerals. (5) Pegmatites-pneumatolites-hydrothermalites—narrow low temperature crystallization interval.

R. A. H.

LE BAS (M. J.). *The term eucrite*. Geol. Mag., 1959, **106**, 497-502.

An account of the history of the term 'eucrite' since its introduction by Rose in 1863. The term has been used both for meteoritic, and for a great variety of terrestrial rocks. It is proposed that for most of the latter the term 'gabbro', with or without prefixes, could be used with less ambiguity. A new analysis of a porphyritic dolerite from Carlingford is given, for comparison with the 'type eucrite'.

G. M. B.

SØRENSEN (H.). *On the agpaitic rocks*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **13**, 319-327.

The various definitions of agpaitic rocks are reviewed and discussed. It is concluded that they may be best defined as per-alkaline nepheline syenites, containing aegirine, sodic amphibole, and/or ænigmatite instead of biotite, diopside, pyroxene, and hornblende, together with complex Zr- and Ti-silicates instead of zircon and sphene; they are rich in F, Cl, and  $\text{H}_2\text{O}$  which are present in complex silicates such as eudialyte and rinkolite. The most important occurrences of agpaitic rocks are reviewed and the various theories of their formation are discussed. It is concluded that they are formed from sub-alkaline magmas by means of the concentration of volatile compounds rich in Na, Zr, and  $\text{H}_2\text{O}$ .

R. A. H.

BURRI (C.). *Petrochemie der Capverden und Vergleich mit capverdischen Vulkanismus mit demjenigen des Rhinlandes*. Schweiz. Min. Petr. Mitt., 1960, **40**, 115-112 figs.

A compilation of the 65 existing rock analyses of Cape Verde Islands is presented. Only Niggli values in no weight per cents. are given. There are two normal basaltic differentiation series and also two more basic series arising from lime assimilation. The petrographic province of the Cape Verde Islands is shown to be very similar to the volcanic province of the Rhineland.

M. W.

SIMONEN (AHTI). *Pre-Quaternary rocks in Finland*. Bull. Comm. géol. Finlande, 1960, **191**, 1-49.

The paper forms the explanatory notes to the geological map of Finland (1:2,000,000) compiled by the same author.

V. M.

ERMAN (W. R.) & BUTCHER (N. E.). *The geology of the Devonian and Carboniferous rocks of the north-west border of the Dartmoor granite*. Proc. Geol. Assoc., 1959, **70**, 51–92.

structural-stratigraphic account of the area, with a geological map, is accompanied by petrographic notes on contemporaneous igneous rocks and on the metamorphic pole of the granite, where cummingtonite-anthophyllite-lherite rocks are recorded.

R. StJ. L.

T (N.), BEAVON (R. V.), & FITCH (F. J.). *Sub-aerial volcanicity in Snowdonia*. Nature, 1958, **181**, 508.

the bulk of Snowdonian acid volcanics are welded tuffs and a subsidiary basic lavas derived from numerous small sub-aerial explosive vents.

C. H. K.

CKER (G. P. L.). *An occurrence of mugearite in Antrim*. Geol. Mag., 1960, **97**, 62–64, 1 fig.

his occurrence at Y Bridge, near Stonyford, is the first mugearite to be described from the Tertiary lavas of Antrim. It is petrographically a typical mugearite though differing from the Portree, Skye, type rock in the greater abundance of augite and the absence of hornblende and epidote. The rock analysis is close to that of the type mugearite but even closer to that from Ben More, Mull.

M. G. B.

NCIS (E. HOWEL). *A volcanic vent in the Bogside Mines, Fife*. Geol. Mag., 1959, **96**, 457–469, 3 figs.

volcanic vent measuring approximately 500 ft. × 100 ft. pierces the Upper Limestone Group (Namurian) and has been exposed by coal-mine workings at a level of about 150–250 ft. below the contemporary surface. A lithic breccia consisting of comminuted local sediments forms a narrow outer lining with a basaltic tuff as the core. The breccia is discussed in relation to the Swabian tuff-pipes. The structure of the country rocks and the nature of the breccia fragments are related to the state of induration of the sediments at the time of vent formation.

G. M. B.

AN (SYED M.). *The Bigga House basic igneous complex, New South Wales*. Geol. Mag., 1959, **96**, 442–452.

complex of diorites, meladiorites, and hornblendites (1½ mls × 1½ mls) is completely enclosed by the massive, Upper Devonian Bigga granite. The relationships amongst the basic rocks were not mappable, but modal analyses, petrographic descriptions, and two new chemical analyses (of a diorite and a quartz diorite) are given. The presence of pyroxene cores in amphibole and of calcic cores in plagioclases, as well as hybridization at the contact zones, suggest that the granite magma has reacted with a gabbroic rock to produce the diorite complex.

G. M. B.

LAPADU-HARGUES (PIERRE) & MAISONNEUVE (J.). *Le champs filonien de Porto-Vecchio (Corse)*. Bull. Carte géol. France, 1957 (for 1956), **54**, 521–529.

This region, composed of a biotite granite occasionally containing amphibole, is traversed by a network of large dikes mainly microgranites. The latter are consanguineous, from the magmatic point of view, with the granites of Bavella (A), Ospedale (B), and Cagne (C) the analyses of which are:—

|   | SiO <sub>2</sub> | Al <sub>2</sub> O <sub>3</sub> | Fe <sub>2</sub> O <sub>3</sub> | FeO  | MgO  | CaO  | Na <sub>2</sub> O | K <sub>2</sub> O | H <sub>2</sub> O+ | H <sub>2</sub> O— | Total  |
|---|------------------|--------------------------------|--------------------------------|------|------|------|-------------------|------------------|-------------------|-------------------|--------|
| A | 76.3             | 13.9                           | 0.85                           | 0.25 | 0.2  | 0.6  | 4.4               | 3.9              | 0.35              | tr.               | 100.85 |
| B | 74.55            | 12.9                           | 0.9                            | 0.9  | 0.3  | 0.65 | 5.3               | 3.65             | 0.55              | 0.2               | 100.1  |
| C | 68.65            | 17.8                           | 2.2                            | 1.45 | 1.35 | 2.6  | 3.05              | 2.1              | 0.60              | 0.15              | 100.15 |

Totals for A, B, & C include, respectively, TiO<sub>2</sub> 0.05, 0.15, 0.15. MnO 0.05, 0.05, 0.05.

E. J. & A. S.

JÉRÉMINÉ (ELISABETH) & SANDRÉA (ANDRÉ). *Contribution à l'étude lithologique de l'île d'Ouessant (micro-granites et tourmalinites)*. Bull. Carte géol. France, 1958 (for 1957), **55**, 49–55.

The microgranites of Ouessant [Ushant] are leucocratic or hololeucocratic rocks, sometimes crushed. One, exceptional for its extreme richness in potash and poverty in soda has been analysed: SiO<sub>2</sub> 61.70, Al<sub>2</sub>O<sub>3</sub> 15.55, Fe<sub>2</sub>O<sub>3</sub> 3.50, FeO 1.95, MgO 2.60, CaO 1.50, Na<sub>2</sub>O 0.50, K<sub>2</sub>O 8.55, H<sub>2</sub>O+ 2.10, H<sub>2</sub>O— 0.30, TiO<sub>2</sub> 0.75, ZrO<sub>2</sub> 0.09, P<sub>2</sub>O<sub>5</sub> 0.70, MnO tr., =99.79. Pseudo-dikes, 2 metres wide, 20 to 14 metres long, appear on the SW coast. Black tourmaline (dravite) constitutes 95% of the rock; quartz, apatite, monazite, very rare thorites and brookite are accessory; zones rich in oligoclase or in quartz are found. The adjacent garnetiferous muscovite schists are rich in tourmaline which has probably entered by lateral diffusion.

J. PH.

LAPADU-HARGUES (PIERRE). *Le massif granitique de Saint-Dier (Puy-de-Dôme)*. Bull. Carte géol. France, 1958 (for 1957), **55**, 129–142.

A geological and petrographical study of the granite of Saint-Dier and neighbouring granites. 13 chemical analyses include 10 of typical calc-alkaline granites, and 3 of fine-grained granites poor in CaO.

E. J. & A. S.

JÉRÉMINÉ (E.), GÈZE (B.), & CHRISTOPHE-MICHEL-LÈVY (M.). *Sur la présence de leucite dans les basanites des Causses*. C.R. Acad. Sci., Paris, 1958, **246**, 798–800.

The presence of leucite has been established, by microscopical and X-ray examination, in the veins in some analcime basanites of Causses (Larzac, Lodève). Chemical analyses of basalt from Agde (A), and of leucite basanites (B & C) are given.

|   | SiO <sub>2</sub> | Al <sub>2</sub> O <sub>3</sub> | Fe <sub>2</sub> O <sub>3</sub> | FeO  | MgO   | CaO   | Na <sub>2</sub> O | K <sub>2</sub> O | H <sub>2</sub> O+ | H <sub>2</sub> O— | Total  |
|---|------------------|--------------------------------|--------------------------------|------|-------|-------|-------------------|------------------|-------------------|-------------------|--------|
| A | 49.78            | 10.43                          | 6.48                           | 4.92 | 8.65  | 10.06 | 3.19              | 1.29             | 0.87              | —                 | 100.26 |
| B | 41.35            | 12.25                          | 9.25                           | 7.00 | 10.50 | 11.00 | 3.05              | 2.50             | 0.25              | 0.10              | 100.53 |
| C | 43.71            | 13.81                          | 5.78                           | 7.41 | 5.67  | 11.96 | 4.39              | 1.96             | 1.00              | 0.14              | 99.95  |

Totals include, for A, B, & C respectively, TiO<sub>2</sub> 3.81, 2.10, 3.98; P<sub>2</sub>O<sub>5</sub> 0.78, 0.70, 0.64; MnO n.d., 0.24, n.d.

A. S.

SIAT (ALBERT), WEIL (RENÉ), & COUTURIER (ALBERT).

*Sur un filon d'ankaratrite à mélilite recoupant le granite des Crêtes, près du Valtin (Vosges). C.R. Acad. Sci., Paris, 1958, 246, 2915-2917.*

A dyke of ankaratrite, marginally very altered, contains phenocrysts of olivine, pyroxene, and subordinate biotite disseminated in a groundmass in which can be recognized microlites of pyroxene and melilite, with biotite, magnetite, a little nepheline, pyrite, and sodalite. Analysis of the ankaratrite from Valtin gives  $\text{SiO}_2$  32.20,  $\text{Al}_2\text{O}_3$  8.80,  $\text{Fe}_2\text{O}_3$  7.65,  $\text{FeO}$  4.85,  $\text{MgO}$  15.00,  $\text{CaO}$  14.60,  $\text{Na}_2\text{O}$  3.20,  $\text{K}_2\text{O}$  1.25,  $\text{H}_2\text{O}+$  7.55,  $\text{H}_2\text{O}-$  0.70,  $\text{TiO}_2$  2.00,  $\text{P}_2\text{O}_5$  0.40,  $\text{MnO}$  0.05,  $\text{H}_2\text{S}$  1.90, = 100.15. Ankaratrites are known at Essey-la-Côte (near Lunéville). E. J. & A. S.

BROUSSE (ROBERT). *Présence d'analcime primaire dans la pâte des phonolites à hauyne du Mont Dore (Auvergne). C.R. Acad. Sci., Paris, 1959, 248, 1545-1546.*

The presence of analcime was proved by X-ray diffraction analysis. The analcime is of pneumatolytic origin.

E. J. & A. S.

CARRAT (HENRI G.) & WEBER (FRANCIS). *Présence dans le Morvan d'un nouveau granite hercynien antérieur au granite de Luz. C.R. Acad. Sci., Paris, 1958, 246, 963-966.*

Till the present, following the work of Auguste and Albert Michel-Levy, the Luz granite was considered the only Hercynian granite of Morvan. The authors think the granite of Gien-sur-Cure is another, older Hercynian granite. It is generally non-porphyrific, always rich in biotite accompanied sometimes by green hornblende; chemically it is richer in calcium, iron, and magnesium than the Luz granite.

E. J. & A. S.

DIDIER (JEAN) & ROQUES (MAURICE). *Sur les enclaves des granites du Massif-Central français. C.R. Acad. Sci., Paris, 1959, 248, 1839-1841.*

The migmatitic granites of the Massif Central of France contain enclaves of crystalline schists. The true granites enclose enclaves of microgranular acid or basic rocks. This distribution suggests a direct granitization of the crystalline schists for the former type and a granitization later than the emplacement of a microgranular mass for the latter.

E. J. & A. S.

KLEINSMIEDE (W. F. J.). *Geology of the Valle de Arán, Central Pyrenées. Leidse Geol. Mededelingen, 1960, 25, 129-245, 77 figs., 10 tables, 5 sections, 1 map, (Spanish summary).*

Results of field work undertaken on low-grade metamorphic, highly folded Palaeozoic rocks, are given. Although the main subject is structural geology, late Carboniferous

intrusives are also described; they consist of dykes (quartz porphyries and hornblende-diorite-porphyries) and granodiorites. Chemical analyses of the dykes are given.

P. C. Z.

WEIBEL (M.). *Chemismus und Mineralzusammensetzung von Gesteinen des nördlichen Bergeller Massivs. Schweiz. Min. Petr. Mitt., 1960, 40, 69-93, 8 figs.*

Ten chemical and modal analyses of the Tertiary Berg granodiorites are given. Separated fractions of the feldspars of all the 10 samples were analysed spectrochemically. The K-feldspars contain 14-30% Ab, the plagioclases 17-32% An. The plagioclases were also determined by means of the universal stage. The rocks of the Berg intrusion are showed to be mainly granodiorites and not granites as might be concluded from the misleading designation of 'Bergeller Granit'.

M. G.

BURRI (C.). *Die Eruptivgesteine der Punta delle Pietre Nere (Prov. Foggia, Italien). Schweiz. Min. Petr. Mitt., 1960, 40, 5.*

The so-called 'garganite' rocks are compared with mafic schlieren in alkali-basaltic lavas. [Detailed paper will appear in *Eclogae geol. Helveticae*]

M. W.

WEISER (TÁDEUSZ). *Petrographic provinces of the northern Carpathians. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 13, 39-46, 2 figs.*

The magmatic activity of the northern Carpathians began long before the igneous activity of the Carpathian Flysch geosyncline. Granodiorites, tonalites and their acid derivatives, in association with injection gneisses and hornfels are the result of large scale granitization during the (Palaeozoic) batholithic stage. In the genetically related metamorphic rocks all grades from the greenschist to granulite facies can be distinguished. Igneous activity in the Carpathian Flysch geosyncline included ultraferric eruptions, synorogenic diabase-spilite formation, and acid volcanic rocks.

R. A. H.

SEMENENKO (N. P.), RODIONOV (S. P.), USENKO (L. S.), LICHAK (I. L.), & TSAROVSKY (I. D.). *Stratigraphy of the Pre-Cambrian of the Ukrainian shield. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 9, 108-115.*

The Ukrainian shield consists of three large rock complexes: the Precambrian II includes the Dnieper group of gneisses, migmatites, and granodiorites, the Volyn-Podolia group of gneisses and granites, and the Bug group of pyroxene gneisses and migmatized charnockite-monzonitic rocks. The Precambrian III includes sedimentary-volcanic and intrusive formations, the Krivoy Rog group including spilite-keratophyre assemblages. The Precambrian

des the Priazov alkaline complex of gabbro-syenites, syenites, and nepheline syenites.

R. A. H.

RD (JULES). *Les ankaratrites et le volcanisme récent de la région de Zebzat (Haut Atlas de Midelt)*. Notes Serv. géol. Maroc, **15**, no. 135, 1958 (for 1956), 109–117.

The outcrops of the ankaratrites lie on the northern border of the Haut Atlas. They include dikes, necks, very few flows with and without melilite, and lavas containing melilite and aegirine-augite; breccias with vermiculite are associated. Of early Quaternary age the ankaratrites are analogous to the types of the same age in the rest of Morocco. The Zebzat ankaratrite has the mineral composition, estimated by integrating stage, melilite 20, melilite 12.5, augite 30, olivine 20, titanomagnetite 10.5, pyroxene 7%; the chemical composition is  $\text{SiO}_2$  38.70,  $\text{Fe}_2\text{O}_3$  9.30,  $\text{FeO}$  4.47,  $\text{FeO}$  8.40,  $\text{MgO}$  15.10,  $\text{CaO}$  13.50,  $\text{K}_2\text{O}$  0.93,  $\text{K}_2\text{O}$  0.62,  $\text{H}_2\text{O} +$  1.95,  $\text{H}_2\text{O} -$  0.65,  $\text{TiO}_2$  3.60,  $\text{MnO}$  0.55,  $\text{MnO}$  0.21,  $\text{CO}_2$  0.10, = 100.08. E. J. & A. S.

AVSKY (GEORGES). *Présence de trachytes dans les laves associées aux couches rouges du Permo-Trias dans le Maroc oriental et la Haute Moulouya*. Notes Serv. géol. Maroc, 1959, **17**, 51–54.

regarded up till now as basalts, certain Permo-Triassic rocks of eastern Morocco and the Haute Moulouya are trachytes. A description is given; they are vesicular and highly carbonatized and sericitized, and among the accessory minerals are found celadonite and manganite (anourat). E. J. & A. S.

SONNAS (JEAN). *Stades successifs de la formation du massif de granit intrusif d'In-Tounine (Hoggar central)*. C.R. Acad. Sci., Paris, 1959, **248**, 432–433.

This complex intrusion is formed by three varieties of granite. The oldest (A), of fine grain, is cut by a coarse-grained granite (B). Intrusive into these two is the third (C), which is fine-grained, rich in albite, and contains topaz. Good associations of cassiterite and wolframite are associated with each variety. Chemical analyses give:

|   | $\text{SiO}_2$ | $\text{Al}_2\text{O}_3$ | $\text{Fe}_2\text{O}_3$ | $\text{FeO}$ | $\text{MgO}$ | $\text{CaO}$ | $\text{Na}_2\text{O}$ | $\text{K}_2\text{O}$ | Ign. loss | $\text{TiO}_2$ | Total  |
|---|----------------|-------------------------|-------------------------|--------------|--------------|--------------|-----------------------|----------------------|-----------|----------------|--------|
| A | 74             | 15.1                    | 0.6                     | 1.8          | 0.6          | 2.5          | 3.6                   | 4.7                  | 1.2       | 0.1            | 99.7   |
| B | 45             | 14.56                   | 0.73                    | 2.88         | 0.26         | 1.18         | 3.70                  | 4.80                 | 0.30      | 0.11           | 100.15 |
| C | 59             | 14.87                   | 0.70                    | 0.93         | 0.18         | 0.81         | 4.90                  | 3.90                 | 0.70      | 0.10           | 99.80  |

include  $\text{MnO}$  —, 0.10, 0.12,  $\text{P}_2\text{O}_5$  0.1, 0.08, tr. for A, B, C respectively.

E. J. & A. S.

MAEGHE (MARCEL). *L'éruption du volcan Mugogo au Kivu*. C.R. Acad. Sci., Paris, 1958, **246**, 2917–2920.

The 3-cratered volcano Mugogo was formed during the eruption of 1st August, 1957, in the central area of the Kivu volcano (Kivu). Two types of lava were observed, a compact type forming the bottom of the flow and as bombs, and a vesicular type as bombs, ashes, and scoriaceous

lava. The chief minerals are olivine, clinopyroxene, melilite (åkermanite + gehlenite), very little leucite; normative nepheline must be occult in the glass. Five analyses (A–E) show that these lavas are ankaratrites. Mugogo is the first volcano within historical times to possess an ankaratrite composition.

|   | $\text{SiO}_2$ | $\text{Al}_2\text{O}_3$ | $\text{Fe}_2\text{O}_3$ | $\text{FeO}$ | $\text{MgO}$ | $\text{CaO}$ | $\text{Na}_2\text{O}$ | $\text{K}_2\text{O}$ | $\text{TiO}_2$ | $\text{P}_2\text{O}_5$ | $\text{H}_2\text{O} +$ | Total  |
|---|----------------|-------------------------|-------------------------|--------------|--------------|--------------|-----------------------|----------------------|----------------|------------------------|------------------------|--------|
| A | 40.04          | 9.62                    | 5.68                    | 6.19         | 11.98        | 15.32        | 3.67                  | 2.50                 | 2.61           | 1.45                   | 0.41                   | 100.05 |
| B | 40.15          | 9.58                    | 9.57                    | 1.95         | 12.21        | 15.25        | 4.08                  | 2.17                 | 2.71           | 1.50                   | 0.25                   | 99.69  |
| C | 40.37          | 8.61                    | 4.69                    | 7.33         | 13.03        | 15.04        | 3.64                  | 2.13                 | 2.50           | 1.37                   | 0.27                   | 99.44  |
| D | 40.72          | 9.53                    | 3.99                    | 7.62         | 12.68        | 15.06        | 3.50                  | 2.25                 | 2.76           | 1.45                   | 0.38                   | 100.37 |
| E | 41.06          | 10.89                   | 4.70                    | 6.13         | 10.87        | 14.80        | 3.61                  | 2.25                 | 2.80           | 1.29                   | 0.54                   | 99.34  |

The totals include  $\text{MnO}$  0.21, 0.21, 0.23, 0.27, 0.27;  $\text{H}_2\text{O} -$  0.41, 0.25, 0.27, 0.38, 0.54;  $\text{CO}_2$  0.06, 0.04, 0.20, 0.11, 0.05 for A, B, C, D, & E respectively.

E. J. & A. S.

GRANTHAM (D. R.) & ALLEN (J. B.). *Kimberlite in Sierra Leone*. Overseas Geol. Min. Res., 1960, **8**, 5–25, 2 figs., 6 pls. (Geol. Surv. Dept. Sierra Leone, Short Paper No. 8).

Diamonds occurring in alluvium were traced to a source-area S.E. of Sefadu where a series of narrow kimberlitic dykes have been found. The dykes are highly weathered but relatively fresh specimens obtained from drill-cores have been petrologically studied, and contain serpentine pseudomorphs, phlogopite, calcite, perovskite, apatite, and an opaque material. Xenoliths of adamellite, granodiorite, eclogite, and garnetiferous serpentinite are numerous. A chemical analysis is given for kimberlite from Koidu, Sierra Leone, and two by P. J. Moore, for perovskite (A) from the Koidu kimberlite and perovskite (B) from a typical specimen of the De Beers kimberlite from South Africa: a partial analysis of garnet from a Sierra Leone kimberlite showed it to have  $\text{MgO}$  21.2,  $\text{Fe}_2\text{O}_3$  2.8,  $\text{FeO}$  8.1,  $\text{Cr}_2\text{O}_3$  2.64. The diamonds often show an abraded appearance, even on stones collected directly from the kimberlite, and subsequent re-growth with clear diamond is sometimes observed. These features are taken to imply considerable fracturing at depth before crystallization of the diamonds was completed.

|   | $\text{CaO}$ | $\text{TiO}_2$ | $\text{Nb}_2\text{O}_5$ | Total Fe( $\text{Fe}_2\text{O}_3$ ) | R.E. + $\text{ThO}_2$ | $\text{Ta}_2\text{O}_5$ | Res. | Total |
|---|--------------|----------------|-------------------------|-------------------------------------|-----------------------|-------------------------|------|-------|
| A | 38.30        | 54.01          | 0.92                    | 1.17                                | 3.11                  | —                       | 0.39 | 97.9  |
| B | 38.70        | 56.20          | 0.58                    | 1.50                                | 2.40                  | <0.20                   | 0.32 | 99.7  |

R. A. H.

ARRIBAS (A.). *Las formaciones metamórficas del Sahara Español y sus relaciones con el Precámbrico de otras regiones Africanas*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **9**, 51–58, 3 figs.

A geological synthesis on the western region of the Spanish Sahara compares its Precambrian formations with the metamorphic series of French West Africa. Hypersarthenic garnetiferous and amphibolitic gneisses occur in the Adrar facies. Eruptive rocks include gabbros, norites, anorthosites, nepheline syenites, and biotite granites.

R. A. H.

SIMPSON (E. S. W.) & OTTO (J. D. T.). *On the Precambrian anorthosite mass of southern Angola*. Rept. 21st Intern. Geol. Congr. Norden, 1960, Part 13, 216-227, 2 figs.

A Precambrian mass of anorthosite and related rocks is exposed over an area of 15,000 square kilometres in south-west Angola [M.A. 14-150]. Previous descriptions of these rocks are summarized and a report is given on the 2,500 square kilometres of the southern part of the mass which lies in northern South West Africa. This consists of a thick succession of coarsely banded dark olivine-bearing anorthosites overlying a basement of pale grey to white massive anorthosite. In the latter persistent bands of calcareous chert occur with occasional areas containing large crystals of deep blue sodalite.

R. A. H.

AGARD (J.). *Les carbonatites et les roches à silicates et carbonates associés du massif de roches alcalines du Tamazert (Haut Atlas de Midelt, Maroc) et les problèmes de leur genèse*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 13, 293-303, 1 fig.

Two series of nepheline syenites occur in Liassic limestones which are converted to marble at the contacts. A younger complex includes metasyenites resulting from the alteration of nepheline syenites, trachytes, alnöites, and tinguaïtes. The dykes and small bodies of coarse-grained carbonatites contain various carbonates together with aegirine-augite, schorlomite (8-10%  $\text{TiO}_2$ ), nepheline, apatite, and more rarely zircon and pyrochlore. The fine-grained carbonatites occur in pipes and contain pyrite, fluorite, apatite, galena, and an unidentified radioactive mineral in addition to carbonates.

R. A. H.

MEYER (A.) & BÉTHUNE (P. DE). *The Lueshe carbonatite (Kivu, Belgian Congo)*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 13, 304-309, 2 figs.

The Lueshe carbonatite consists of a ring of pyroxene-sövite, with accessory apatite, feldspar, pyrochlore, and minor sodic amphibole, surrounding a core of cancrinite-syenite with primary cancrinite. An area of rauhaugite, with 30-90% of the  $\text{MgCO}_3$  molecule in the analyses, occurs at one side of the complex, and has accessory apatite together with pyrite and a colourless amphibole. The surrounding schists are transformed to fine-grained feldspathic rocks akin to adinoles, with occasional aegirine and sodic amphibole. [M.A. 14-154]

R. A. H.

ORTLEPP (R. J.). *A pre-Karoo igneous complex at Trompsburg, Orange Free State, revealed by drilling exploration*. Trans. Geol. Soc. S. Africa, 1959, 62, 33-58, 2 figs., 4 pls.

The presence of this complex was first indicated by gravimetric and magnetometric survey. It lies under a

cover of approximately 3500 feet of Karroo sediments and is considered to be saucer-shaped with a radius of between 12 and 15 miles. The rocks are mainly gabbroic with bands of anorthosite, troctolite, and titaniferous iron ore. Granite occurs near the centre. Chemical analyses of the main rock types are given. The origin is thought to be due to differentiation within a deeper magma chamber controlled principally by the fractionation of clinopyroxene. M.

HECKROODT (RENIER OELOF). *The geology around the dunite pipe on Driekop (Eastern Transvaal)*. Trans. Geol. Soc. S. Africa, 1959, 62, 59-71, 1 fig., 2 pls.

The rocks belong to the early plutonic phase of the Bushveld Igneous Complex which is here divided into five subphases. The order of intrusion is discussed and differentiation considered to have taken place in depth. The dunite occurs in noritic rocks and is therefore thought to have been emplaced as a magma and not have to originate through desilicification of pyroxenite. M. M.

EALLES (H. V.). *The Khale dolerite sheet*. Trans. Geol. Soc. S. Africa, 1959, 62, 81-109, 5 figs., 2 pls.

The petrology of the Khale dolerite sheet, Bechuanaland Protectorate, is described and three new analyses given. It is considered to be of Karroo age and comparable to the Downes mountain type. Differentiation has led to enrichment in silica, alkalis, and iron. Oxidation of iron and volatiles has inhibited its enrichment in the pyroxene. M. M.

HIEMSTRA (S. A.) & VAN BILJON (W. J.). *The geology of the upper Magaliesberg stage and the lower Bushveld Complex in the vicinity of Steelpoort*. Trans. Geol. Soc. S. Africa, 1959, 62, 239-255, 7 figs., 2 pls.

The rocks of the Steelpoort 'bulge' are described and theories for the origin of the Bushveld Igneous Complex briefly reviewed. Evidence for origin from this area is inconclusive. M. M.

MATTHEWS (P. E.). *The metamorphism and tectonics of the pre-Cape formations in the post-Ntingwe thrust belt, S.W. Zululand, Natal*. Trans. Geol. Soc. S. Africa, 1959, 62, 257-322, 10 figs., 2 pls.

Detailed mapping of some 160 square miles in the structurally complex Tugela valley of south-western Zululand has resulted in a revision of the pre-Cape stratigraphy. The Ntingwe series is correlated with the Transvaal Syenite and included are limestones, thought by du Toit to be of the Basement Complex. These are underlain by the Insuzi series (Dominion Reef System) having at their base the Nkandhla series, also considered by du Toit to be of the Basement. Remaining in the Basement Complex

series: the Mfongosi schists and the Tugela migmatites. One age of granite, post-Insuzi, is recognised. The morphic and structural histories of the area are bed.  
M. M.

ZEE (G. L.) & EDWARDS (C. B.). *The Mrima Hill carbonatite, Coast Province, Kenya*. Trans. Geol. Soc. S. Africa, 1959, **62**, 373-395, 1 fig., 3 pls.

The carbonatite is of post-Karoo age and comprises part of the alkaline complex of Jombo. The petrography and mineralogy are described with particular reference to the weathered products. The  $\text{Nb}_2\text{O}_5$  content of the carbonatite is 12-0-18%, and of the weathered rock 0-73%. Six whole and 2 complete analyses of carbonatites are given and two analyses of soils. A partial analysis by H. J. Nel shows the mineral gorceixite gave  $\text{SiO}_2$  1-9,  $\text{Al}_2\text{O}_3$  35-9,  $\text{P}_2\text{O}_5$  16-0, ign. loss ( $\text{H}_2\text{O}$ ) 16-6, =98-5. M. M.

ELMINE (ELISABETH). *Etude pétrographique d'une collection de roches gabbroïques du Betsiriry (Madagascar)*. C.R. 3-me Congrès P.I.O.S.A. (Pan Indian Ocean Science Association), Tananarive, sect. C, pp. 53-71.

Petrographical descriptions of rocks from the masses of Anjozorobe and Telomita, with 14 chemical analyses. The rocks belong to the anorthosite, diorite, allivalite, gabbro, pyroxene and peridotite families, and are on the way to transition into crystalline metamorphic rocks. A. S.

EVANS (G. F.) & JACKSON (R. O.). *The Arabian shield*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **9**, pp. 69-77, 3 figs.

The framework of the shield is granitic, comprising grey gabbro, diorite, adamellite, and related types mostly as contact intrusives. The second most abundant plutonic rocks are calcalkalic granite batholiths and stocks, and there are a few small areas of soda-rich granite, syenite, and gabbro. The plutonic rocks are separated by sediments and volcanics mostly metamorphosed in the greenschist facies. Serpentinities, marbles, and quartzites are common.

R. A. H.

KINE (A.) & WUERZBURGER (U.). *Eruptive rocks of Timna (Negev)*. Bull. Geol. Survey Israel, 1957, **14**, pp. 1-36 pp., 6 figs., 4 pls.

The massif of Timna, Southern Negev, covering an area of about 8 km<sup>2</sup>, contains a variety of granitic and some intermediate and basic rocks. The massif is cut by a multitude of dykes and hydrothermal veins. Most widespread is a fine to medium grained, pink, aplitic granite, composed of microcline-microperthite, with oligoclase, quartz, some biotite, and magnetite. 33 rock analyses are presented, with Niggli parameters, thin section data, and

several microphotographs. The origin of the various rock-types and the chronology of events are briefly discussed.

D. H. Y.

ALEVA (G. J. J.). *The plutonic igneous rocks from Billiton, Indonesia*. Geol. en Mijnbouw, 1960, new ser. **22**, Billiton Issue, 427-436, 3 figs., 5 tables.

The intrusive igneous rocks on the island of Billiton fall into four groups: gabbroic rocks with intersertal-oikocrystalline texture, granodioritic rocks, adamellite rocks with conspicuous porphyritic texture, and granitic rocks with secondary crystalloblastic texture. The intersertal-oikocrystalline texture indicates a complex crystallization history; an origin by magmatic differentiation or by magma blending is discussed. The textures of the granitic rocks (dovetail-like intergrowths of sodic plagioclase in between potash feldspar crystals, and amoeba-like borders around quartz and feldspar phenocrysts) are explained by crystalloblastesis or crystal growth in the solid state. Chemical analyses of 10 different samples, Niggli parameters and bases, C.I.P.W. norms and classification, and modal analyses are given.

C. J. O.

IWASAKI (IWAJI) & KATSURA (TAKASHI). *The difference in chemical composition between Japanese and Manchurian volcanic rocks*. Proc. 8th Pacific Sci. Congr. (Philippines meeting), 1956 (for 1953), **2**, 208-213.

The difference in chemical composition, especially in the trace element content, of certain volcanic rocks in Japan and Manchuria is discussed, with special reference to basaltic rocks of the Tung-ning district, northern Manchuria, and of the Fuji volcanic zone, Japan. Several analyses are given.

W. A. W.

CLARK (R. H.). *Andesite lavas of the North Island, New Zealand*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **13**, 123-131, 4 figs.

Most of the lavas of Tongariro National Park are hyperssthene-bearing andesites; a classification based on phenocryst composition is formulated. The large volume of acid eruptives is considered a serious objection to derivation of the acid and intermediate rocks solely by fractional crystallization of basaltic magma; they are believed to have been produced by fusion of different crystal layers. Ignimbrites are the result of eruption of the acid magma as a fluidized system, by sudden release of pressure on the magma, possibly due to particular tectonic circumstances.

R. A. H.

REED (J. J.). *Chemical and modal composition of dunite from Dun Mountain, Nelson*. New Zealand Journ. Geol. Geophys., 1959, **2**, 916-919, 1 fig.

The following complete analysis by F. T. Seelye of the type dunite, first described by F. von Hochstetter, from Dun Mountain, Nelson province, New Zealand, is given :  $\text{SiO}_2$  39.53,  $\text{Al}_2\text{O}_3$  0.93,  $\text{Fe}_2\text{O}_3$  0.65,  $\text{FeO}$  7.62,  $\text{MgO}$  48.83,  $\text{CaO}$  tr.,  $\text{Na}_2\text{O}$  tr.,  $\text{K}_2\text{O}$  nt. fd.,  $\text{H}_2\text{O}+$  0.89,  $\text{H}_2\text{O}-$  0.16,  $\text{TiO}_2$  0.013,  $\text{MnO}$  0.12,  $\text{P}_2\text{O}_5$  nt. fd.,  $\text{CO}_2$  0.06, S tr.,  $\text{NiO}$  0.32,  $\text{Cr}_2\text{O}_3$  1.01,  $\text{V}_2\text{O}_5$  nt. fd.,  $\text{BaO}$  nt. fd.,  $\text{ZrO}_2$  nt. fd., Cl nt. fd.,  $\text{CoO}$  0.018, = 100.15 (1). The mode of the analysed rock is : olivine 97.5, chromite (chromian spinel) 2.5, chromian diopside tr., serpentine tr. Data on the minerals in Dun Mountain dunite have been given by Ross, Foster, and Myers [M.A. 12-538].

W. A. W.

KEAR (D.) & WOOD (B. L.). *The geology and hydrology of Western Samoa*. Bull. New Zealand Geol. Survey, 1959, **63** (n.s.), 1-92 pp., 41 figs., 5 maps.

The bulletin includes brief petrographic descriptions of the volcanic rocks by R. N. Brothers.

W. A. W.

YAGI (K.). *Petrochemistry of the alkalic rocks of the Ponape Island, western Pacific Ocean*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **13**, 108-122, 6 figs.

Ponape Island, of the Caroline Islands, is a dissected shield volcano of alternate alkalic basaltic lava flows and pyroclastic rocks. The rock types include olivine basalt, nepheline basalt, pierite, monchiquite, trachyandesite, and trachyte : these are briefly described and their chemistry and petrogenesis are discussed with the aid of 14 chemical analyses. Kaersutite is recorded from trachyandesite, and has  $\alpha$  1.681,  $\gamma$  1.710,  $2V_\alpha$  75°,  $\gamma:c$  0°-10°; zoned titanaugite has  $2V$  53-58°,  $\gamma:c$  50-52° in the core and  $2V$  48-53°,  $\gamma:c$  53-57° in the margin.

R. A. H.

McKELVEY (B. C.) & WEBB (P. N.). *Geological investigations in South Victoria Land, Antarctica. Part II—Geology of upper Taylor Glacier region*. New Zealand Journ. Geol. Geophys., 1959, **2**, 718-728, 10 figs.

The area examined shows nearly horizontal Beacon sediments intruded by dolerite sills and dykes. The authors give brief petrographic descriptions of the dolerites (Ferrar dolerites) of which two distinct types are present. [M.A. 14-363]

W. A. W.

PICCIOTTO (E. E.). *Geological reconnaissance of the Sør-Rondane Mountains (Queen Maud Land)*. Nature, 1960, **186**, 740.

The Expedition Antarctique Belge 1957-58 found this massif (23° to 28°E., 72°S.) to be composed of a gneiss complex with widespread migmatitization and local development of dioritic gneisses, crystalline limestone, and calcsilicate gneisses. Later intrusions of diorite and granite, with associated granitic and pegmatitic dykes, occur to the north of the range. There is no mineralization.

D. McK.

TAYLOR (H. P., Jr.) & NOBLE (J. A.). *Origin of the mafic complexes in southeastern Alaska*. Rept. Intern. Geol. Congr., Norden, 1960, Part **13**, 175-2 figs.

Thirty-five ultramafic bodies with associated gabbro exposed along a belt 30 miles wide and 400 miles long in southeastern Alaska. Most are hornblende pyroxene peridotites; when dunite is present, all the ultramafic types occur in consistent zonal arrangement from the coast outwards. The complexes are all intrusive into gabbro. Forsteritic olivine, diopsidic augite, hornblende, magnetite are the only major minerals. There is evidence to indicate that there were magmas of the composition of the several ultramafic rock-types and that these intruded in a consistent sequence. Differentiation or crystal fractionation is not considered to offer an adequate mechanism; it is thought that they were derived by fractional fusion of ultramafic material in the mantle.

R. A. H.

NOBLE (J. A.) & TAYLOR (H. P., Jr.). *Correlation of ultramafic complexes of southeastern Alaska with those of other parts of North America and the world*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **13**, 188-197, 1 fig.

The belt of ultramafic bodies with associated gabbro in southeastern Alaska [preceding abstract] is part of a large arcuate system extending from Alaska to British Columbia and perhaps to Washington, Oregon, and California. Comparisons are made with zoned ultramafic complexes in the Urals, Sweden, Quebec, the Bushveld, and Cornwall.

R. A. H.

JONES (W. R.), PEOPLES (J. W.), & HOWLAND (A.). *Igneous and tectonic structures of the Stillwater complex, Montana*. Bull. U.S. Geol. Survey, 1960, **107**, 281-340.

The Stillwater complex is a Precambrian stratiform gabbro or lopolith, about 18,000 feet thick and 30 miles long along the northeast margin of the Beartooth Mountains. The complex consists of four zones, bottom to top, as follows: the Basal zone, 200 feet thick, medium-grained nepheline syenite rocks; the Ultramafic zone, from 4000 to 6000 feet thick, a succession of layers of bronzitite, granular harzburgite, poikilitic harzburgite, and chromitite; the Banded zone, Upper zones, in aggregate 14,000 feet thick, consisting of layers of norite, anorthosite, troctolite, and gabbro. The thickness of the layers, or lenses, of the complex varies widely. Layers within the major zones exhibit two types of primary structures:—igneous lamination, related to the platy habit of the clinopyroxene, orthopyroxene, plagioclase, is common in the upper part of the Ba-

and in the Upper zone, chiefly in gabbro, anorthosite, pyroxenite; rhythmic layering, involving variations in mineral composition or mode and in texture, is common in the Banded and Upper zones and common in the Ultramafic zone. Serpentinization is widespread in the Ultramafic zone. Pseudointrusive olivine-rich rocks occur in the lower part of the Ultramafic zone. [M.A. 5] K. S.

(H. H.). *Stillwater Igneous Complex, Montana. A quantitative mineralogical study.* With an appendix by J. R. SMITH on *Optical properties of low-temperature plagioclase*. Geol. Soc. America, Mem. 80, 1960, 230 pp., 42 figs., 12 pls. Price \$5.50.

The Stillwater complex of Montana is an intrusion of gabbro in orthopyroxenitic form. The floor and about 16,000 feet of layered gabbro are exposed on the East Boulder plateau. The order in which the essential minerals separated is: olivine, orthopyroxene, plagioclase, and clinopyroxene. Curves are presented to show this order and the changes in the composition of the minerals as crystallization proceeded. A theory to account for rhythmic layering is advanced. The position of the magma is estimated from the composition of the border facies; it is very similar to that of the Bushveld complex. An estimate of the rate of heat loss during crystallization suggests that about 10 cm of crystals are deposited on the floor per year; 17 pages is devoted to elementary evidence from the Bushveld complex, Great Dyke, and Skaergaard intrusion. Eleven new rock analyses are reported, 3 of them correlated with analyses of coexisting minerals. The mineral analyses reported include: 'superior' analyses of orthopyroxenes of the Bushveld including one from the Great Dyke of S. Rhodesia and one from the Bushveld, with  $\text{TiO}_2$ ,  $\text{Cr}_2\text{O}_3$ ,  $\text{MnO}$ , and  $\text{NiO}$  determinations, partial optical data and cell dimensions for these orthopyroxenes; 3 of other orthopyroxenes; 3 pigeonite and inverted pigeonite, including one from the Bushveld; 9 of clinopyroxenes, including 4 from the Bushveld, with full optical properties for each and cell dimensions for 3; 15 of plagioclase ranging from An 44.2 to 66.6. New curves are presented for the correlation of optical properties, density, and cell dimensions with composition of orthopyroxenes and for the extinction angles for perthite-albite twins in calcic plagioclases. Appendix 1 (3 pp.) is entitled 'Products of differentiation by fractional crystallization compared to the calc-alkaline magma series: comments on generation of magmas and a resulting composition gradient in the crust' and appendix 2 (3 pp.) 'Differentiation of dolerite sills'. In appendix 3 by J. R. SMITH (27 pp.), 'Optical properties of low-temperature plagioclase', newly determined optical properties are presented for 23 analysed plagioclases, 8 of which are among

those described by Hess. From these data new curves are constructed for the variation of the three principal refractive indices, the optic angle and the total birefringence with composition of low-temperature plagioclase. A. P.

WARD (RICHARD F.). *Petrology and metamorphism of the Wilmington complex, Delaware, Pennsylvania and Maryland.* Bull. Geol. Soc. America, 1959, 70, 1425-1458, 7 figs., 1 pl.

The Wilmington complex, about 100 sq. miles in area, consists predominantly of layered gneiss, with mafic layers of calcic plagioclase, hypersthene, augite, and commonly hornblende and thick felsic layers of quartz and andesine with minor pyroxene. A granite, occupying about 4 sq. miles in the central part of the complex, consists of orthoclase, oligoclase-andesine, biotite, and pyroxene. The layered gneiss grades into amphibolite, which contains calcic plagioclase, hornblende, and traces of hypersthene; away from the gneiss the amphibolite is hypersthene-free and plagioclase is replaced in part by epidote. The Wilmington complex is intruded by the Port Deposit granodiorite and by a gabbro, both of which are only little altered by the regional metamorphism. Seven gravimetric chemical analyses, with modal analyses, are given for the members of the complex and the amphibolite. Chemical analyses and optical data are given for coexisting hornblende, augite, and hypersthene from one rock, for coexisting augite and hypersthene from 4 others, and for hornblende from four rocks. It is suggested that the gneiss and the amphibolite resulted from the metamorphism of 'basaltic tuffs and flows'. The development of layering and the central granite are believed to have a metasomatic origin. A. L. A.

HAY (RICHARD L.). *Origin and weathering of late Pleistocene ash deposits on St. Vincent, B. W. I.* Journ. Geol., 1959, 67, 65-87.

Calcic plagioclase, hypersthene, augite, and olivine are the most abundant primary crystals in the fresh andesitic ash. The glass and much of the plagioclase have weathered to halloysite.  $4\text{H}_2\text{O}$ , much olivine has gone to iddingsite, and most crystals have been etched. Glass has weathered most rapidly, followed in sequence by anorthite/bytownite and olivine  $\text{Fo}_{74}$ . Olivine  $\text{Fo}_{78-85}$ , hypersthene, and augite weather more slowly and at about the same rate; still more slowly hornblende. Alteration proceeds most rapidly in the less permeable beds (originally the finer ash). Analysis of a porphyritic, pumiceous, andesitic lapillus from Chibarabu Point gave  $\text{SiO}_2$  53.03,  $\text{Al}_2\text{O}_3$  18.78,  $\text{Fe}_2\text{O}_3$  3.76,  $\text{FeO}$  5.49,  $\text{MgO}$  4.02,  $\text{CaO}$  8.72,  $\text{Na}_2\text{O}$  3.14,  $\text{K}_2\text{O}$  0.44,  $\text{H}_2\text{O} +$  1.45,  $\text{H}_2\text{O} -$  0.00,  $\text{TiO}_2$  1.07,  $\text{P}_2\text{O}_5$  0.05,  $\text{MnO}$  0.12,  $\Sigma = 100.07$ . Composition of the glass is calculated.

R. E. W.

HILL (PATRICK ARTHUR). *Geology and structure of the northwest Trinidad Mountains, Las Villas Province, Cuba*. Bull. Geol. Soc. America, 1959, **70**, 1459-1478, 3 figs., 4 pls.

The major rocks of the Trinidad Mts. of central Cuba are carbonaceous carbonate rocks and schists of presumed Mesozoic age. The former comprise limestone (about 90%), brucitic limestone, and dolomite. The most widespread schist is a carbonaceous chloritic mica schist which alternates with quartz-garnet-mica schist or less commonly grades into epidote or talc schists. Nodular serpentinite, greenstone, and amphibolite are believed to be younger. Powder X-ray data are given for chlorite and halloysite, and semi-quantitative spectrographic data for halloysite, nodular serpentinite, greenstone, and amphibolite. A. L. A.

MACKENZIE (D. B.). *High-temperature Alpine-type peridotite from Venezuela*. Bull. Geol. Soc. America, 1960, **71**, 303-318, 2 figs., 4 pls.

The Tinaquillo peridotite is the least serpentinized of the ultramafic masses included in the N. 75° E.-trending belt of Cretaceous metamorphic rocks in Northern Venezuela. It is a south-dipping tabular mass of intensely crushed and foliated dunite bounded on the north by a thrust fault and on the south by hornblende-quartz-plagioclase gneisses which, near the intrusion, have been contact-altered to garnet-augite-hornblende-andesine gneisses. Large tabular masses of gabbroic composition within the peridotite are interpreted as inclusions of contact-altered country rock. The peridotite contains thin hornblende and pyroxene layers parallel to the foliation and also shows lath-shaped orthopyroxene phenocrysts lying flat in parallel crystallographic orientation. The laths are thought to have formed by deformation of equant phenocrysts during final-stage solid intrusion. An amphibole from one of these layers has  $\text{SiO}_2$  43.61,  $\text{Al}_2\text{O}_3$  15.06,  $\text{Fe}_2\text{O}_3$  1.59,  $\text{FeO}$  5.14,  $\text{MgO}$  16.53,  $\text{CaO}$  11.80,  $\text{Na}_2\text{O}$  2.78,  $\text{K}_2\text{O}$  0.11,  $\text{H}_2\text{O} +$  1.69,  $\text{H}_2\text{O} -$  0.05,  $\text{TiO}_2$  1.15,  $\text{MnO}$  0.08, = 99.59, E. H. Oslund, analyst;  $\alpha$  1.643,  $\gamma$  1.659,  $2V_\gamma$  82.4°,  $\gamma:c$  19°. The structure and composition of the pyroxene and garnet in the contact rocks suggest that the temperature of intrusion was between 800°C and 1000°C. During cooling, some of the thin pyroxene layers were altered to hornblende. Later, and at still lower temperature, a belt of dunite along the thrust fault was altered to serpentinite and asbestos. A. L. A.

MCCONNELL (R. B.) & DIXON (C. G.). *A geological map of British Guiana*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **9**, 39-50.

An area of granitic basement rocks, including charnockitic assemblages, is derived from folded and metamorphosed

sediments and igneous rocks of Precambrian age. These overlain by metasediments and metavolcanics which have been folded, regionally metamorphosed, and locally granitized; these rocks are invaded by syntectonic and late tectonic granites. Later intrusions include thick sills and dykes of gabbro and noritic gabbro. R. A. H.

### Petrology : structural, petrogenetic

WATERS (A. C.). *Determining direction of flow in basalts*. Amer. Journ. Sci., 1960, **258**-A, 350-366.

Flow directions may be indicated by inclined columnar jointing which pitches upstream; spiracles, pipe vesicles and vesicle cylinders, rising obliquely from the bottoms of flows, which trail out downstream; or primary flow bedding which is common in palagonite complexes. H. W.

HUNTER (H. E.). *Topographic control by primary igneous structures in the Raggedy Mountains, southwestern Oklahoma*. Oklahoma Geol. Surv., Oklahoma Geological Notes, 1960, **20**, 112-115, 5 figs.

Features of flat outcrop surfaces of gabbroic rocks in part of the Wichita Mountains igneous complex are controlled primarily by preferred orientation of mineral grains. Individual units differing in the relative proportions of felsic and mafic minerals are recognised, their boundaries being parallel to the plane of preferred plagioclase orientation and to the outcrop surfaces. Layers rich in ferromagnesian minerals weather more readily than the anorthositic layers. R. A. H.

COUSINS (C. A.). *The structure of the mafic portion of the Bushveld Igneous Complex*. Trans. Geol. Soc. S. Africa, 1959, **62**, 179-189, 3 figs., 1 pl.

An alternative to the classical conception of the Bushveld Igneous Complex as a lopolith is proposed. The geophysical and geological evidence accord with the concept of a trough-like structures of similar type to the Great Dyke of Southern Rhodesia separated by updomed rocks of the Transvaal System. The Bushveld rocks are thought to be along a deep fracture zone extending from the Great Dyke in the north to the buried Trompsburg complex of Orange Free State in the south. A 10-page discussion follows. M. M.

FERINGA (G.). *The geological succession in a portion of the north-western Bushveld (Union section) and its interpretation*. Trans. Geol. Soc. S. Africa, 1959, **62**, 222, 9 figs., 1 pl.

Irregularities within the differentiated zone of the Bushveld Complex and, in particular, the occasional absence of the Merensky reef are explained by the theory that

all rocks were gently folded before the emplacement of the Merensky reef, the fresh magma first filling the cracks and giving rise to a structure analogous to a sedimentary disconformity. It is also suggested that this fresh magma may have been locally extruded.

M. M.

WYLLIE (COLIN). *An outline of the geology of the Kapalagulu Complex, Kungwe Bay, Tanganyika Territory, and aspects of the evolution of layering in basic intrusives.* Trans. Geol. Soc. S. Africa, 1959, **62**, 1-30, 7 figs., 2 pls. This is a layered complex showing rhythmic and cryptic layering and igneous lamination. It is intrusive into the Precambrian System. The layers have been tilted into a near-vertical attitude. The rock types range from bronzite picrite in the basal zone through olivine hyperite in the intermediate zone to hyperite in the main zone. Subsidiary dykes comprise a sulphide layer in the basal zone, an iron-sulphide band in the main zone, and quartz gabbro and granodiorite near the upper contact. Theories to account for the rhythmic layering are reviewed and the author proposes a hypothesis of rhythmic nucleation and gravity settling resulting in at least one addition of fresh magma. M. M.

DE VRIES (A.) & TAUBENECK (W. H.). *Layered intrusions.* Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **13**, 239-246.

The authors postulated mechanisms for the formation of cryptic layering in layered intrusions are reviewed, and particular reference is made to small dykes and funnel-shaped mafic intrusions associated with granitic batholiths in Oregon and California [M.A. **14**-364]. In these bodies developed rhythmic layering occurs with crystals oriented at high angles to the bedding. This type of layering is attributed to undercooling combined with convective or turbulent currents in the magma.

R. A. H.

TRZCINSKI (G. A.). *Magmatic formations and their classifications.* Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **13**, 94-95.

The main magmatic rocks are classified into the 8 types: (1) oceanic olivine-basalt; (2) platformic (non-orogenic continental regions) formations—trap, gabbro-granophyre, etc.; (3) rocks of primary geosynclines—spilite and ultrabasic formations; (4) rocks of secondary geosynclines—quartz-keratophyre, plagiogranite; (5) the granodioritic group; (6) rocks of brachygeosynclines—granite; (7) magmatic rocks of intermontane basins—basalt-trachyte, nordmarkite; (8) granitoid rocks.

R. A. H.

RÖSLER (H. J.). *Bemerkungen zur Genese von Geosynklinalmagmatiten.* Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **13**, 96-107.

Petrographic and geochemical evidence on the genesis of the basic and acid magmatic rocks of Devonian and Lower Carboniferous age in Thuringia, Eastern Germany, is discussed. The intrusive and extrusive geosynclinal diabases, spilites, rhyolites, and keratophyres are particularly considered.

R. A. H.

THAYER (T. P.). *Some critical differences between alpine-type and stratiform peridotite-gabbro complexes.* Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **13**, 247-259.

Evidence is presented to show that alpine-type peridotite complexes were intruded as differentiated crystal mushes, and that gabbro and peridotite were mixed during emplacement.

R. A. H.

SIMONEN (AHTI). *Petrographic provinces of the plutonic rocks in the Svecofennides of Finland.* Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **13**, 28-38, 4 figs.

Petrographic provinces of orogenic plutonic rocks of granodiorite, trondhjemite, charnockite, and granite suites containing basic, intermediate, and acid plutonic rock types are recognised, though there is a preponderance of acid types. Migmatite-forming microcline granites in southern Finland take a unique position among the orogenic plutonic rocks; they show evidence, however, of metasomatic granitization. [Following abstract]

R. A. H.

SIMONEN (AHTI). *Plutonic rocks of the Svecofennides in Finland.* Bull. Comm. géol. Finlande, 1960, **189**, 1-101, 49 figs.

On the basis of the petrographic and chemical characteristics, the Svecofennidic plutonic rocks in Finland are divided by the author into five provinces: granodiorite province; trondhjemite province; charnockite province; granite province; migmatite-forming microcline granites. Mineralogical and chemical differences between different provinces appear especially in silicic end members, which usually deviate by a marked compositional break from one to another. The geological and petrographic features suggest that the granodiorite, trondhjemite, charnockite and granite provinces are of magmatic origin. Great quantities of acid magma may have formed locally by complete or differential fusion of various rocks in deep levels of the earth's crust. The geological and petrographic features of the microcline granites show that metasomatic processes have played an essential role in their origin. Data on the physical and chemical properties of individual minerals

of the rocks are given. The mineralogical composition of the rocks is described by variation diagrams. The chemical characteristics of the rock provinces are shown by variation diagrams based on 148 analyses. [Previous abstract]

M. H.

EARDLEY (A. J.). *Igneous and tectonic provinces of western United States*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **13**, 18-27, 4 figs.

The structures of the deformed miogeosyncline and shelf areas have had little effect on the position, size, and composition of the intrusive and extrusive bodies. The eugeosyncline, on the other hand, is the master belt of orogeny and is closely related to the igneous activity, and the batholithic magmas are believed to have been generated by the melting of silicic roots. The igneous activity associated with the miogeosyncline and shelf are explained by the rise of basalt from the mantle and its injection as giant sills under the sial, leading to the melting and assimilation of basal parts of the sial.

R. A. H.

SEARLE (E. J.). *Petrochemistry of the Auckland basalts*. New Zealand Journ. Geol. Geophys., 1960, **3**, 23-40, 9 figs.

Thirteen new analyses of lavas from Auckland, shown to be olivine-rich alkaline basalts, are presented and discussed. They are chemically comparable with lavas from the Pacific basin but possibly derived by crystallization-fractionation along a trend characteristic of a continental environment. The composition of the Auckland rocks (late Pleistocene to Recent) is compared with that of Pliocene-Pleistocene basalts from the north and south parts of Auckland province. The origin of olivine nodules and of a nepheline basanite associated with the Auckland basalts is considered. [Author's abstract]

W. A. W.

BROTHERS (R. N.). *Olivine nodules from New Zealand*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **13**, 68-81, 13 figs.

The textures of some olivine nodules from New Zealand reveal a succession of minerals which can be accounted for in terms of a normal sequence of paragenetic crystallization from the enclosing basalt magma. Translation lamellae parallel to {100} are present in the olivine of the nodules and in occasional euhedral phenocrysts of the lava: these lamellae are interpreted as the result of gravity deformation by the superincumbent load of crystals within the magma chamber. The olivine ranges from Fo<sub>92</sub> to Fo<sub>82</sub>, the orthopyroxene from En<sub>92</sub> to En<sub>85</sub>, and the clinopyroxene from Ca<sub>46</sub>Mg<sub>45</sub>Fe<sub>9</sub> to Ca<sub>48</sub>Mg<sub>41</sub>Fe<sub>11</sub>. A dark brown spinel and laths of a colourless zeolite also occur. Petrofabric analysis gives diagrams similar to those for olivines with preferred orientation in intrusive peridotites.

R. A. H.

JUAN (V. C.). *On the parental magma-type of the graphitic province of eastern Taiwan*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **13**, 82-93, 1 fig.

The chonolith magma type of Taiwan is thought to be identical with the Mull plateau magma or the olivine basalt magma of Kennedy. Since the tholeiitic magma of Kennedy has been demonstrated to be derived from olivine basalt through crystallization-differentiation, and since the Taiwan chonolith magma is shown by a simple process of differentiation to be the parent of the plateau magma of Washington, it is concluded that the chonolith magma of Taiwan or the olivine basalt of Kennedy is the 'primary basalt magma' from which all the different types of magmas have been derived. The particular type of mineralogical development in the original magma at the time of emplacement mainly controls the nature of subsequent differentiation.

R. A. H.

TUTTLE (O. F.) & BOWEN (N. L.). *Origin of granite in the light of experimental studies in the system NaAlSi<sub>3</sub>O<sub>8</sub>-KAlSi<sub>3</sub>O<sub>8</sub>-SiO<sub>2</sub>-H<sub>2</sub>O*. Geol. Soc. America, Memoir 115, 1958, 153 pp., 67 figs., 6 pls. Price \$3.75.

This is the much delayed report of Bowen's last collaboration with Tuttle. In the preface, dated December 27, 1954, written by Tuttle, there is reference to the 'tragic circumstances when Bowen's health prevented him from taking an active part in the presentation and analysis of the data'. A half of the book is devoted to a review of earlier experimental work and a report on the results of new experiments. Following an extended section on methods, the crystallization phases and the several subsystems are described. Results on parts of the system NaAlSi<sub>3</sub>O<sub>8</sub>-KAlSi<sub>3</sub>O<sub>8</sub>-H<sub>2</sub>O are given for higher pressures than previously [M.A. 11-12]. New results on the systems NaAlSi<sub>3</sub>O<sub>8</sub>-SiO<sub>2</sub>-H<sub>2</sub>O and KAlSi<sub>3</sub>O<sub>8</sub>-SiO<sub>2</sub>-H<sub>2</sub>O and on the quaternary system of NaAlSi<sub>3</sub>O<sub>8</sub>-KAlSi<sub>3</sub>O<sub>8</sub>-SiO<sub>2</sub>-H<sub>2</sub>O are given in 25 pages. Liquidus surfaces are shown on Ab-Or triangles for H<sub>2</sub>O pressures of 500, 100, 2000, and 10000 Kg/cm<sup>2</sup>. In this interval the isobaric minimum on the quartz-feldspar boundary is lowered from about 770°C to about 670°C. Following a brief discussion of granitic rocks, rhyolites, and the isobaric minima, experiments on the beginning of melting of the Westerly, Rhode Island granite, Quincy, Massachusetts, granites in the presence of water vapour under pressure are reported, together with limited observations on the composition of the vapour in equilibrium with hydrous granitic melts and on the stability of amphiboles. The rest of the book is devoted to a discussion of familiar petrological problems and providing the light of the experiments under the following headings: Wiborgite rapakivi granite (5 pp.), Tertiary granite of the Sierra Nevada (19 pp.), geothermal gradients and granite magmas (10 pp.), classification of salic rocks (4 pp.), feldspar crystallization (10 pp.).

volites, trachytes, and phonolites (7 pp.), and evolution of granitic textures (5 pp.).

A. P.

ILTON (WARREN). *Silicic differentiates of lopoliths*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **13**, 59–67, 2 figs.

The silicic differentiates of the Bushveld, Wichita, Sudbury, and Duluth lopoliths are alkaline rocks, high in silica and total iron, low in CaO and  $Al_2O_3$ : granophyres, perthitic granites, and rhyolites are widespread. These differentiates are contrasted with the basalt-rhyolite and granodiorite-granite associations of the silicic rocks of calc-alkaline provinces. Each lopolith is a stratigraphical unit and the Bushveld, Sudbury, and Duluth lopoliths are overlain by extrusive rhyolites, which have their distinctive compositions. These lopoliths are probably essentially extrusive.

R. A. H.

CKEISEN (A.). *On the structure and origin of the nepheline-syenite complex of Ditro (Transylvania, Roumania)*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **13**, 228–238, 2 figs.

The structure and contact relations of the nepheline-syenite complex of Ditro, on the margins of the eastern Carpathians, are described. The Ditro complex is intermediate between the agpaite and miaskitic rock-groups and has a definite magmatic origin. The probable succession of events in the formation of the complex is outlined.

R. A. H.

OBIEVA (O. A.). *Alkali rocks of the U.S.S.R.* Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **13**, 17–17, 1 fig.

A review of the alkaline rocks of the U.S.S.R. indicates that the periods of their intrusion coincide with the paroxysms of conjunctive tectonic activity and that their distribution is controlled by large-scale ruptures of the earth's crust. Two trends of alkaline petrogenesis are first, an abysmal differentiation of ultrabasic and basic magmas with a massive alkali accumulation in a relatively quiescent stage over a long period of balanced  $P$ - $T$  conditions, and second, a progressive increase of alkalinity with the evolution of different magmatic structures.

R. A. H.

IN (H.), MATHIAS (M.), & SIMPSON (E. S. W.). *The Damaraland sub-volcanic ring complexes in South West Africa*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **13**, 156–174, 7 figs.

A review is given of the group of post-Triassic ring complexes of sub-volcanic type situated along a well-defined belt between the Ugab and Khan rivers in the Damaraland region of South West Africa. These rocks range from ultramafic to over-saturated or to feldspathoidal

types sometimes accompanied by carbonatites. Brief descriptions are given of the Erongo, Spitzkoppe, and Brandberg granite plutons, the Cape Cross, Doros, Okonjeje [M.A. **13**–12], and Messum [M.A. **13**–12, **14**–70] differentiated basic complexes, and of the Kalkfeld, Okorusu, Ondurakorum, and Paresis Mountains alkali complexes.

R. A. H.

WYLLIE (P. J.) & TUTTLE (O. F.). *Experimental verification for the magmatic origin of carbonatites*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **13**, 310–318, 3 figs.

Largely a condensed repetition of earlier reports [M.A. **14**–334, 406]. The addition of MgO to the ternary system  $CaO-CO_2-H_2O$  lowers the minimum liquidus temperature at 1000 bars from 675° to 625°. It is probable that differentiation occurs in multi-component magmas by separation of the successive liquid fractions produced by crystallization of calcite, dolomite, and chalybite. Preliminary runs on the system  $Ca_3(PO_4)_2-CaCO_3-Ca(OH)_2$  suggest that near the join  $CaCO_3-Ca(OH)_2$  there is a ternary isobaric invariant point involving the four phases liquid, calcite, portlandite, and apatite: at 1000 bars this eutectic will be at less than 685°C.

R. A. H.

WYLLIE (PETER J.). *The system  $CaO-MgO-FeO-SiO_2$  and its bearing on the origin of ultrabasic and basic rocks*. Min. Mag., 1960, **32**, 459–470, 3 figs.

A petrological interpretation of the experimental data on the system  $CaO-MgO-FeO-SiO_2$  investigated by Ricker. Because of the shape of the liquidus and solidus surfaces in the plane  $Mg_2SiO_4-Fe_2SiO_4-Ca_2SiO_4$ , i.e., a plateau in the large olivine field, a liquid can change composition appreciably with only a slight change in the composition of the olivine crystals precipitated, and a small change in temperature can cause a considerable change in composition of the liquid. A number of basic and ultrabasic rock analyses projected on to this plane fall not far from the line  $Mg_2SiO_4-CaFeSiO_4$  which corresponds approximately to a valley on the liquidus which flattens out to the plateau. If this plateau exists in the multicomponent system which represents natural basalts and peridotites, fusion of peridotite would generally produce only basalt throughout a considerable range of temperature. However, a slight rise in temperature over a certain 'critical' temperature would result in the formation of magmas much richer in olivine. This may account for many picritic rocks which are difficult to explain as accumulative types. The plateau feature also exists in part of the system  $CaO-MgO-FeO-Al_2O_3-SiO_2$ .

W. S. M.

DREVER (H. I.). *Immiscibility in the picritic intrusion at Igdlorssuit, west Greenland*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **13**, 47–58, 5 figs.

A globular structure in a picrotic minor intrusion can be interpreted as the result of either the previous existence of a liquid phase within another immiscible liquid phase or bubbles of a late-magmatic gas phase. The former explanation is favoured. The globules are of variable size and are surrounded by a veneer of magnetite which makes them quite conspicuous and there is evidence of coalescence or disruption of the globules. Crystals of both pyroxene and plagioclase are seen to pass from the groundmass into the globules and the magnetite layer is undisturbed. Many of the globules contain no zeolite, in others it is a prominent constituent but is confined to the upper parts of the globules. A chemical analysis of the zone containing the globules shows that it is richer in  $\text{Fe}_2\text{O}_3$ ,  $\text{TiO}_2$ , and  $\text{K}_2\text{O}$  than the adjacent rock.

W. S. M.

DE WYS (E. CHRISTIAAN). *A possible explanation of immiscibility in silicate melts.* Min. Mag., 1960, **32**, 471–479, 2 figs.

A list of systems involving  $\text{SiO}_2$  or  $\text{B}_2\text{O}_3$  as one of the components are given and those in which liquid immiscibility occurs are indicated. From crystal-chemical and other considerations it is deduced that the dominant type of silicate anionic structure is preserved in the liquid immediately above the liquidus temperature. It is thereafter suggested that the anionic grouping in the silicate is the determining factor as to whether or not a system will show liquid immiscibility. Only those compounds which have the following type of complexes have an immiscible relationship with a liquid such as  $\text{SiO}_2$ :  $(\text{SiO}_4)^{4-}$ ,  $(\text{Si}_2\text{O}_7)^{6-}$ ,  $(\text{Si}_3\text{O}_9)^{6-}$ ,  $(\text{Si}_4\text{O}_{12})^{8-}$ ,  $(\text{Si}_6\text{O}_{18})^{12-}$ ,  $(\text{SiO}_3)^{2-}$ ,  $(\text{Si}_4\text{O}_{12})^{6-}$ .

W. S. M.

LAFFITTE (P.). *La formation des 'minéralisateurs' et des fluides juvénils.* Bull. Soc. franç. Min. Crist., 1960, **83**, 113–117, 4 figs.

In a closed system the fluid phases released by metamorphism or by magmatic rheomorphism will be identical. In an open system, however, the selective distillates will not be the same for the two hypotheses. In hydrothermal veins the deposition is related to falls in pressure, and certain solution effects to falls in temperature. The fundamental importance of variations of pressure is stressed. R. A. H.

### Volcanology, &c.

MINAKAMI (TAKESHI) & MORIMOTO (RYOHEI). *Volcanic activities in Japan during the years 1949–1953.* Proc. 8th Pacific Sci. Congr., (Philippines meeting), 1956 (for 1953), **2**, 241–252, 5 figs.

The chief activity described included the volcanism at Mount Mihara at Oshima volcano (1950–51) and the submarine eruptions of Myojin reef near the Beyonnaise Rocks

(Sept., 1952), respectively 110 and 400 km south of Tokyo. Temperatures and calculated viscosities for the 1951 lavas from Mount Mihara, and analyses by G. Osaka of rocks from Mount Mihara, Mount Asama, and Myojin reef, are given.

W. A. W.

NOGUCHI (KIMIO). *Geochemical investigations of geysers in Japan.* Proc. 8th Pacific Sci. Congr. (Philippines meeting), 1956 (for 1953), **2**, 228–240, 11 figs.

Brief descriptions of Japanese geysers are given, with tables and graphs illustrating their physical and chemical characteristics.

W. A. W.

HEALY (J.). *The hot springs and geothermal resources of Fiji.* New Zealand Dept. Sci. Industr. Res., 1960, Bull. **136**, 77 pp., 12 figs.

The hot springs of Fiji are described, with many water analyses and notes on the geology. The most important hot spring area is at Savusavu on the south coast of Vanua Levu. A typical water analysis from this locality gives (in p.p.m.):  $\text{Na}^+$  1390,  $\text{K}^+$  44,  $\text{Ca}^{2+}$  1450,  $\text{Cl}^-$  4617,  $\text{HCO}_3^-$  42.6,  $\text{CO}_3^{2-}$  nil,  $\text{H}_2\text{CO}_3$  12.6,  $\text{HBO}_2$  11.3,  $\text{F}^-$  1.6. The available evidence indicates that the springs are fed by meteoric water which has penetrated to shallow depths, heated by contact with hot rock, and rises to the surface along faults. Saline water originating in some places from the sea and in others possibly from connate water entrapped in the rocks, augments the meteoric water. Temperatures are mostly below  $60^\circ\text{C}$ , although some springs, including Savusavu, are hotter than this. Figures for the heat discharged from the different hot springs are given.

W. A. W.

GREGG (D. R.). *The geology of Tongariro subdivision.* Bull. New Zealand Geol. Survey, 1960, **40** (n.s.), 152 pp., 69 figs., 5 maps.

The bulletin includes lengthy descriptions of the active volcanoes Ruapehu and Ngauruhoe. The petrology of the volcanic rocks is described by R. H. CLARK (pp. 107–122). Except for minor rhyolite and ignimbrite the rocks are andesites of which several types, based on the phenocryst content, are recognised; gradation, however, exists between the different types. Mineralogical data on labradorite, augite, pigeonite, olivine, basaltic hornblende, and minor minerals are given, with brief descriptions of textures and inclusions within the lavas. Petrochemical relations, with analyses by J. A. Ritchie and F. T. Seelye, of the volcanic rocks found over the whole central part of the North Island including those of the Tongariro area, are discussed. It is considered that two parental materials were involved in the formation of the volcanic rocks, melting of a lower layer producing basaltic magma, and fusion of the overlying silicic shell producing acidic magma much of which was

ted as ignimbrite. Mingling of the two parental  
erials, either by convectional mixing or by assimilation  
eated acidic rock by fractionating basaltic magma,  
l have produced the andesite. [M.A. 14-362]

vestigations of Ketetahi hot springs, Mount Tongariro,  
described by S. H. WILSON (pp. 124-144). Analyses  
uses from hot pools and fumaroles, and of hot springs  
stream waters draining them, are given. W. A. W.

ILTON (W. M.) & BAUMGART (I. L.), compilers. *White  
Island [New Zealand]*. New Zealand Dept. Sci.  
Industr. Res., 1959, Bull. 127, 84 pp., 20 figs., 1 map.  
The bulletin deals with the history and aspects of the  
ral history of White Island, an active volcano in the  
of Plenty (lat. 37°31'S., long. 177°11'E.). The island  
ilt of andesite flows and pyroclastics. About 10,000  
of sulphur have been mined, but little now remains.  
I. GRANGE (pp. 25-31) describes the volcanology of the  
d 1927-29; analyses of hot spring waters, gases from  
roles and hot springs, and fresh and decomposed rocks  
included. An analysis of a small phosphate deposit  
ed by the action on andesite of waters percolating from  
ent gannet droppings shows that the chief substance  
ent is callinite ( $\text{AlPO}_4 \cdot 2\frac{1}{2}\text{H}_2\text{O}$ ).

H. WILSON (pp. 32-50) describes physical and chemical  
stigations undertaken between 1939 and 1955. Analysis,  
A. D. Nash, of the water from a boiling pool gives  
(litre):  $\text{Al}^{3+}$  2.03,  $\text{Fe}^{3+}$  0.14,  $\text{Fe}^{2+}$  11.34,  $\text{Mn}^{3+}$  0.26,  
7.31,  $\text{Ca}^{2+}$  2.56,  $\text{Sr}^{2+}$  0.01,  $\text{Na}^+$  7.67,  $\text{K}^+$  1.00,  $\text{NH}_4^+$   
3,  $\text{H}^+$  0.504,  $\text{Cl}^-$  61.84,  $\text{HSO}_4^-$  8.21,  $\text{SO}_4^{2-}$  2.34,  $\text{S}_4\text{O}_6^{2-}$   
 $\text{S}_5\text{O}_6^{2-}$  0.01,  $\text{F}^-$  0.87,  $\text{Br}^-$  0.04,  $\text{I}^-$  0.006,  $\text{H}_2\text{SiO}_3$  0.23,  
 $\text{O}_2$  0.026,  $\text{HAsO}_2$  0.009,  $\text{H}_2\text{S}$  0.03, total solids 85.8.  
t from water vapour, carbon dioxide is the most  
rtant constituent of gas samples collected from boiling  
s and fumaroles; the other main constituents are  $\text{H}_2\text{S}$ ,  
 $\text{CH}_4$ , and  $\text{N}_2$ . Analyses of condensates from fumaroles  
also given, a typical example being (in g/100ml):  $\text{HCl}$   
 $\text{H}_2\text{SO}_4$  0.49,  $\text{H}_2\text{SO}_3$  nil,  $\text{H}_2\text{S}$  0.08,  $\text{HF}$  0.029,  $\text{NH}_4\text{OH}$   
12,  $\text{H}_3\text{BO}_3$  nil. Up to 0.073 g/100ml of boric acid is  
ent in other fumaroles. Brief descriptions of salt  
stations within the crater and of deposits around  
roles are also given. W. A. W.

(E.). *Volcanic eruption in Belgian Congo*. Journ.  
Geophys. Res., 1959, 64, 580. [Letter to the editor.]  
brief eruption on the northern side of Nyamuragira  
rred on August 7, 1958. A swarm of earthquakes with  
itudes up to 2.6 preceded the eruption by 3 hours.

Lava outflow continued to November 21 and travelled  
about 20 km. F. R. B.

FISHER (RICHARD V.). *Criteria for recognition of laharc  
breccias, southern Cascade Mountains, Washington*.  
Bull. Geol. Soc. America, 1960, 71, 127-132, 1 fig.

Comparison of properties of laharc (volcanic mudflow)  
and pyroclastic breccias leads to the conclusion that the  
two described volcanic breccias near Mt. Rainier, Washing-  
ton, originated as lahars. Such deposits suggest that rapid  
denudation of nearby volcanoes was an important process  
in the accumulation of the lower Tertiary andesitic material  
within the southern Cascade Mountains of Washington.

A. L. A.

PARSONS (W. H.). *Origin of Tertiary volcanic breccias,  
Wyoming*. Rept. 21st Intern. Geol. Congr., Norden,  
1960, Part 13, 139-146.

Middle Eocene pyroclastic rocks of the Absaroka  
Mountains and Yellowstone National Park are mainly  
breccias with some agglomerates and a small percentage of  
interbedded tuffs and lava flows. Most of the breccias were  
formed by the fragmentation of previously crystallized  
volcanic rocks apparently during or before extrusion of the  
breccias from dozens of small vents. R. A. H.

TOBI (ALEXANDER C.). *Volcanisme occulte dans les grès  
d'Allevard (Permien) et dans le Houiller du Massif  
de Belledonne (Isère)*. C.R. Acad. Sci., Paris, 1958,  
246, 3654-3656.

The lower Permian sandstone of Alleverd and the sand-  
stones and arkoses of the Belledonne massif contain pebbles  
of and crystals from rhyolite, not known up to the present  
as flows in the Belledonne massif. Also the author has  
found tuff with crystals of biotite and zircon on Grande  
Lauzière. The top Coal Measures of Roche Rousse contains  
pebbles of tuff and agglomerate. Thus, an explosive  
volcanism, difficult to recognize, has played an important  
role in part of the Belledonne massif during Permian and  
Coal Measures times. [M.A. 14-427] E. J. & A. S.

BOUT (PIERRE). *Considérations à propos des ignimbrites*.  
C.R. somm. Soc. géol. France, 1958, 8, 189-191.

Following Fenner (1923, Katmai) and Einarssen (1945,  
Iceland, basaltic lavas), the author concludes that there  
exists a type of extrusion which is relatively calm and  
produces eruptive, cryptofragmental or apparently brecci-  
ated formations—effusive elastic acid or basic rocks.

E. J. & A. S.

## TOPOGRAPHICAL MINERALOGY

ERS (C. A.) & STEWART (F. H.). *p-Veatchite from  
Yorkshire*. Min. Mag., 1960, 32, 500-501.

The mineral from the Permian lower evaporite bed of the

Eskdale No. 2 boring described as veatchite [M.M. 30-389]  
has  $a$  6.74,  $b$  20.62,  $c$  6.63Å,  $\beta$  119°38'; space group  $P2_1/m$   
or  $P2_1$  and is thus shown to be *p*-veatchite [BRAITSCH,

Beitr. Min. Petr., Univ. Gottingen, 1959, **6**, 352]. Veatchite is monoclinic [A.M. **44**–1141], but with space group  $A2/a$  or  $Aa$ .

R. A. H.

KINGSBURY (A. W. G.) & HARTLEY (J.). *Carminite and beudantite from the northern part of the Lake District and from Cornwall*. Min. Mag., 1960, **32**, 423–432.

The parageneses and localities are given of ten new occurrences of carminite,  $PbFe_2(AsO_4)_2(OH)_2$  [M.M. **15**–525], and eleven of beudantite,  $PbFe_3AsO_4SO_4(OH)_6$ , in Cumberland and Cornwall. Carminite is unstable and alters under certain conditions of oxidation or weathering to beudantite. Beudantite itself may alter to plumbojarosite or beaverite or to both. At Wheal Gorland, Gwennap, Cornwall, beudantite occurs in association with mimetite and with zeunerite, the latter having  $n$  1.608 and giving an X-ray powder pattern almost identical with that for synthetic hydrous zeunerite [M.A. **11**–323].

R. A. H.

LUCAS (M.) & ZAGHLOUL (Z.). *Uraninite concentrate from South Crofty mine, Camborne, Cornwall*. Trans. Roy. Geol. Soc. Cornwall, 1960 (for 1957–1958), **19**, 113–115, 2 figs.

X-ray powder data and an autoradiograph are presented for a 90% uraninite concentrate.

R. A. H.

ROBINSON (A. J.). *Geological report for 1959*. Bull. Soc. Jersiaise, 1960, **17**, 290–292.

A pegmatite at Ronez, Jersey, has well-formed crystals of pink orthoclase, lustrous brown crystals of sphene, and thin almost colourless needles of apatite. Veins of fluorite, galena, blende, and hematite, in a gangue of calcite, are recorded in granite at St. Brelade.

R. A. H.

WALKER (G. P. L.). *The amygdale minerals in the Tertiary lavas of Ireland. III. Regional distribution*. Min. Mag., 1960, **32**, 503–527, 8 figs.

Zeolites occur at most of the 670 localities studied in the Antrim Basalts, the ten most abundant species, in order of frequency, being chabazite [M.M. **29**–773], thomsonite, analcime, levyne, natrolite, mesolite, stilbite, gmelinite [M.M. **32**–202], heulandite, and phillipsite. Gismondine, laumontite, and mordenite are recorded for the first time. Chabazite and thomsonite characterize the upper lavas, whereas lower in the succession analcime and natrolite are also present, and in areas of intense zeolitization stilbite and heulandite are found. These mineral zones probably reflect the temperature distribution in the lavas during zeolitization and are discordant and clearly superimposed upon the lavas. The tholeiite lavas occupying a small area in north Antrim have a different amygdale mineral assemblage from these olivine basalts; they contain

abundant celadonite and also quartz, chalcedony, and in addition to zeolites whose habits differ in detail from those of the olivine basalts. [M.M. **17**–305, **29**–773].

R. A. H.

FOJT (B.). *Die Erzminerale aus dem Steinbruch bei Ondrášov (Andersdorf) im Niederen Gesenke (Mähren)*. Acta Musei Moraviae, Brno, 1957, **42**, 27–32, 5 figs. (in Czech; Russian and German summaries).

Blende with microscopic inclusions of magnetic pyrite, galena, pyrite, and chalcopyrite occurs in the Devonian rocks of this quarry. This is the first recorded occurrence of sulphide ores from this area of Devonian rocks.

J. L.

STANĚK (J.). *Vismut a bismutit z pegmatitu u Maršikova sev. Moravě* [Bismuth and bismutite in pegmatite near Maršikov in northern Moravia]. Acta Musei Moraviae, 1957, **42**, 33–38, (English & Russian summaries).

Additional minerals now found in the beryl pegmatite Scheibengraben near Maršikov (Marschendorf), northern Moravia, include: grains of bismuth ( $4 \times 2$  mm) in quartz with radially fibrous coatings of bismutite; crystals of zircon (2 to 3 mm) grown in coarse albite-pegmatite; topaz; and, only found once, finely acicular bavenite.

J. L.

ČECH (F.). *Bavenit von Maršikov (Marschendorf) in Nordmähren*. Přírodověd. Sborník Ostravského k. úst. Opava, 1957, **18**, 285–291, (in Czech; German summary).

Bavenite occurs as aggregates of small scales which penetrate the bundles of muscovite in pencils. Since only a little beryl is present and it is well-preserved a primary origin is most probable for the bavenite. Maršikov is the first European locality at which chrysoberyl has been recognized; it occurs in sillimanite pegmatite.

J. L.

ČERNÝ (PETR). *The second occurrence of hawleyite, Blatná*. Časopis Min. Geol., Praha, 1957, **2**, 13–16.

A mixture of hawleyite and greenockite was found in small cavities in weathered blende in Tertiary propylitic andesite at the hill Bučník near Komňa, south-eastern Moravia. The mineral association in the ore veins is malachite, blende and arsenopyrite, minor pyrite, pyrrhotine, magnetite, galena, chalcopyrite, with many secondary minerals. Hawleyite was identified by chemical and optical tests and by powder pattern;  $a = 5.815 \text{ \AA}$ .

J. L.

ČECH (F.). *Priorite (blomstrandin) z Pozdátěk u Třebíče* [Priorite (blomstrandine) from Pozdátky near Třebíč]. Časopis Min. Geol., 1957, **2**, 346–349, (German summary).

the first discovery of priorite in Czechoslovakia has been in pegmatite in the syenite of Trebitsch-Grossbritsch (West Moravia). It occurs, with zircon and apatite, as grains up to 1 cm of metamict crystal fragments in the forms {001}, {010}, {110}, {021}, and {101}. A microanalysis is given.

J. N.

ČEK (K.). *Nová naleziště železitých krámenů a přehled jejich výskytů v Barrandienu* [New localities for eisenkiesel and review of its occurrence in the Barrandian]. *Časopis Národního Musea*, 1958, **127**, 183–190.

15 new occurrences of eisenkiesel from the lower, middle-Bohemian Ordovician of the region between Sv. Dobrotivá (Benigna), Žebrák, and Hořovice, and in the area between Radnice and Zbírč (around Sebečice and Janov) are described in detail. All the occurrences described up to and from the Barrandian are included in the review and their genesis is discussed.

J. KÚ.

ČEK (K.). *Nové nálezy chalcedonu a karneolu v pokrkonoském permokarbonu* [New localities for chalcedony and carnelian in the Riesengebirge Permo-Carboniferous]. *Časopis Národního Musea*, oddíl přírodovědný, 1959, **128**, 27–33.

A zone of clay and limestone in the lower part of the Riesengebirge stretches east and west of Stará-Paka and Nová-Paka in northern Bohemia. It contains the localities for chalcedony, carnelian, and jasper already known [M.A. 1953] and also the newly discovered localities, Plouznice, Lomnice, the neighbourhood of Ždár below Kumburg, and Borovnice, E.N.E. of Nová-Paka. The varieties described microscopically, one spectrographic analysis given, and the origin of the silica aggregates discussed.

V. S.

ČEK (K.). *Poznámky k novým nálezům nerostů českých rudných žil a ložisk* [Observations on new mineral occurrences from Czechoslovakian ore veins and deposits]. *Časopis Národního Musea*, 1959, **128**, 122–129.

15 new localities are discussed: psilomelane, wad, chalcocopyrite from Utur near Havlíčkův Brod; minerals in the ore-veins of Plánicka area near Klatovy; minerals in the ore-veins of Číhaň near Klatovy; psilomelane from Blatná near Blaník; hematite from Adolfov near Blatná; new sulphide occurrences at Libušín close to Blatná; and quartz from Píchnovice near Tanvald in the Riesengebirge. All the minerals belong to the apomagmatic, or metallogenic Pb-Zn veins which cut the crystalline schists and are genetically connected with the middle-Bohemian intrusion or with the Bohemian-Moravian intrusion.

J. KÚ.

TUČEK (K.). *Nové nálezy nerostů v Československu—New finds of minerals in Czechoslovakia*. *Sborník Národního Musea v Praze* (Acta Mus. Nat. Pragae), 1959, **15**, 61–110, 4 pls., (in English; Czech summary).

The study includes: minerals of the eruptive rocks—axinite and microcline from granites, thomsonite and aragonite from the Tertiary igneous rocks of the Bohemian Mittelgebirge; minerals of the sediments—new occurrences of calcite crystals from the Carboniferous and Chalk around Beroun, chalybite from the Pilsen coal-basin; minerals of the crystalline schists—calcite, gypsum, and garnet, and skarn minerals, rutile, amphibole, apatite, and pyrrhotine from Hutě near Bechyně; ore minerals—marcasite crystals from the old deposits in Kašperské Hory (Bergreichenstein) and Stříbro (Mies), chalcocopyrite from the neighbourhood of Nový Kuín, and hematite, massive and specular varieties, from Herlíkovice in the Riesengebirge. The geological relations of the locality, the most important optical and crystallographic constants, spectrographic analyses are given for 37 new occurrences, and X-ray diagrams for 13 minerals.

J. KÚ.

NASHAR (BERYL) & DAVIES (M.). *Secondary minerals of the Tertiary basalts, Barrington, New South Wales*. *Min. Mag.*, 1960, **32**, 480–491, 2 figs.

Secondary minerals in the Tertiary amygdaloidal basalts of the Barrington area, northwest of Newcastle, include cream or cherry-red montmorillonite, chabazite, natrolite, chalcedony, calcite, and perhaps manganite. They are considered to have been deposited from cold solutions after consolidation of the basalts, the soluble materials having been derived from the basalts by circulating meteoric waters rather than by deuteric activity. The process has been reported to be taking place at the present day at a temperature of about 5°C.

R. A. H.

SREENIVAS (B. L.). *Bixbyite from Nagpur*. *Nature*, 1958, **181**, 864, 1 fig.

Bixbyite has been found in association with braunite in manganese ores from Joda, East Nagpur. Powder data agree fairly well with those given for bixbyite from the Thomas Range in Utah. [M.A. 9–4]

C. H. K.

OTA (R.). *Druse in basalt and trachybasalt of Japan (I)*. *Journ. Japanese Assoc. Min. Petr. & Econ. Geol.*, 1958, **42**, 207–215, 5 figs., (Japanese and English summary).

— Ditto. (II). *Ibid.*, 285–295, 5 figs., (Japanese and English summary).

— *Druse in andesite and trachyandesite of Japan (I)*. *Ibid.*, 1959, **43**, 64–72, 3 figs., (Japanese and English summary).

- Ditto. (II). Ibid., 144–153, 6 figs., (Japanese and English summary).
- *Druse minerals from Suzugadake*. Journ. Soc. Earth-scientists & Amateurs, Japan, 1959, **10**, 205–213, 1 fig., 1 pl., (Japanese and English summary).
- *Druse minerals in Japanese volcanic rocks*. Ibid., 1959, **11**, 155–163, 2 figs., 1 table, (Japanese and English summary).
- *Druse in dacite of Japan*. Ibid., 1960, **33**, 1–8, 4 tables, (Japanese and English summary).

Detailed petrographic and mineralogical surveys of druses and druse minerals in basalt and trachybasalt (10 localities), andesite and trachyandesites (14 localities), and dacites (4 localities) of Japan have been carried out. Described in these papers are modes of occurrences of druses, petrographical observations on mother rocks, mineralogical characteristics (mainly physical and optical properties) of druse minerals, parageneses and the sequences of crystallization of druse minerals in each locality. Minerals found in druses are: in trachybasalt—plagioclase, cristobalite, common augite, pargasite, phlogopite, hypersthene, ilmenite, magnetite, and bronzite; in basalt—above minerals with anorthoclase and tridymite, but no bronzite; in andesite—same minerals as in basalt and also  $\alpha$ -quartz; in trachyandesite—tridymite, pargasite, phlogopite, and ilmenite; in dacite—tridymite,  $\alpha$ -quartz, pargasite, fayalite, magnetite, garnet, osumilite, biotite, and rhombic pyroxene. Tridymite crystals are classified into 3 different types—thin platy hexagonal, wedge-shaped, and long prismatic.  $2V(+)$  of pargasite in druses is larger than that of metamorphic and plutonic rocks. The value of refractive index of phlogopite in druses is lower than that of phlogopite in pegmatite.  $2V$  of hypersthene in druses is smaller than that in compact lava. Crystallization sequence of minerals is schematically shown for each locality. Geneses of druse minerals are discussed. Either contamination from other rocks or volatile substances in the original magma is responsible for the formation of druse minerals. I. S.

ARMSTRONG (H. S.). *Marbles in the 'Archean' of the southern Canadian Shield*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **9**, 7–20, 1 fig.

Contrary to general belief carbonate rocks of sedimentary origin occur in a number of localities among the typical 'Archean' rocks of the Superior and Churchill provinces. The marbles may be found associated with quartzites, black pelites, or banded iron formations. Much of the marble is believed to have been derived from stromatolitic limestones. Some of these marbles occur with the oldest rocks of the Canadian shield, affording indirect evidence of early life.

R. A. H.

ROSSMAN (DARWIN L.). *Geology and ore deposits of northwestern Chichagof Island, Alaska*. Bull. U.S. Geol. Survey, 1959, **1058-E**, 139–216.

Bedded rocks ranging in age from Palaeozoic(?) through early Cretaceous were intruded by gabbro, quartz diorite, norite-gabbro, and younger quartz diorite. Mafic and felsic dikes, in almost equal proportions, have a wide range of age. Gold is the most important mineral commodity. Nickel and copper deposits are associated with some of the igneous rocks [M.A. **10**–229]. K. I.

WISE (WILLIAM S.). *Occurrence of wairakite in metamorphic rocks of the Pacific Northwest*. Amer. Min., 1959, **44**, 1099–1101, 1 fig.

Wairakite is identified in low grade metamorphic terranes and tuff breccias from the Keechelus(?) formation of Mount Rainier, National Park, Washington. X-ray diffraction patterns when made by scanning at  $\frac{1}{4}^\circ/\text{min}$  show double peaks for 400 and other reflections, thus distinguishing wairakite from analcite. L. G. I.

MILTON (CHARLES) & FAHEY (JOSEPH J.). *Classification and association of the carbonate minerals of the Green River formation*. Amer. Journ. Sci., 1960, **258**, 242–246.

The geographical distributions of the twenty different carbonate minerals in this formation demonstrate variation in the geochemistry of the Green River Basin (Wyoming), Washakie Basin (Wyo.), Uinta Basin (Utah), and Piceance Creek Basin (Colorado). The minerals studied include nahcolite, trona, an unnamed species of composition  $\text{Na}_4\text{H}(\text{CO}_3)_2 \cdot 2\text{H}_2\text{O}$ ; calcite, magnesite, chalybite, witherite, dolomite, barytocalcite, norsethite [M.A. **14**–343; **45**–252]; eitelite [M.M. **30**–732; A.M. **40**–326]; shortburbankite [M.M. **30**–729; A.M. **38**–1169]; thermonatrite; natron; pirssonite, gaylussite; dawsonite, northupite, and bradleyite. H. V.

HEYL (ALLEN V.), MILTON (CHARLES), & AXELROD (JOSEPH M.). *Nickel minerals from near Linden, Iowa and Wisconsin*. Amer. Min., 1959, **44**, 995–1009, 12 figs.

Near Linden, Wisconsin, millerite is associated with violarite and bravoite(?). All three have been partially altered to a green, yellow, and orange product of nickel sulfate or related sulfates. Millerite was deposited near the end of the main period of the deposition of primary sulfides. The other nickel minerals are products of oxidation and secondary enrichment of the millerite. A type of symmetrical twinning in millerite suggests lower symmetry than the trigonal scalenohedral.

A. C.

## VARIOUS TOPICS

W. E., Jr.). *High-temperature chlorination of TiO<sub>2</sub>-bearing minerals*. Trans. Metallurgical Soc., A.I.M.E., 1960, **218**, 6-12, 11 figs.

study of the chlorination ratio of several TiO<sub>2</sub> minerals made. The role of HCl in chlorination of iron from the minerals is discussed. A relationship with the initial iron content was found. The rate is proportional to the weight of O<sub>2</sub> and to the partial pressure of CO and Cl<sub>2</sub>. The activation energy is 20.9 kcal. Chlorination with COCl<sub>2</sub> was found to be considerably faster than with CO+Cl<sub>2</sub>.

R. G. Wls.

L. (C. C.) & JERE (G. V.). *Some thermodynamical considerations in the chlorination of ilmenite*. Trans. Metallurgical Soc., A.I.M.E., 1960, **218**, 219-225, 3 figs., 2 tables.

chlorination of the constituents of ilmenite by different methods in the presence of various reducing agents, has been considered on the basis of standard free energy and standard enthalpy changes as functions of temperature. Standard free energy change considerations show that it is beneficial to chlorinate ilmenite by chlorine in the presence of carbon and also that the iron of ilmenite can be essentially chlorinated by chlorine, titanium tetrachloride, or their mixture.

R. G. Wls.

MINCKX (S.) & DELAVIGNETTE (P.). *Observation of dislocations in non-metallic layer structures*. Nature, 1960, **185**, 603-604.

Transmission electron microscopy of thin cleavage flakes revealed the presence of dislocations in Bi<sub>2</sub>Te<sub>3</sub>, Sb<sub>2</sub>Te<sub>3</sub>, graphite, muscovite, and talc. Hexagonal networks have been found in the basal plane of muscovite. In graphite edge dislocations are split into partials. In talc equilibrium separation of dislocations is 0.2μ, implying a very low stacking fault energy.

D. McK.

FR (C. L.) & GORDON (R. B.). *Dislocation damping effects in rock salt*. Journ. Appl. Phys., 1960, **31**, 945-949, 3 figs., 2 tables.

Internal friction measurement made as a function of frequency, amplitude, elastic modulus measurements during irradiation, and etch pit density determinations on sodium chloride single crystals were used to evaluate the parameters in theories of dislocation vibration phenomena (Mato & Lücke 1956, Gordon & Nowick 1956). The authors conclude that these theories are useful representations of such phenomena and permit the use of internal friction measurement for the continuous observation of dislocations.

R. G. Wls.

KAPLAN (T. A.). *Classical theory of spin configurations in the cubic spinel*. Journ. Appl. Phys., 1960, **31** (suppl. to no. 5), 364S-365S.

Since the Yafet-Kittel triangular spin configurations do not minimize the classical Heisenberg exchange energy in the spinel, a re-examination of the problem was undertaken. It was found that the ground state in the cubic spinel is probably a long-range ordered canted-spin arrangement, for at least some finite range of  $y$  to  $y_0$ . The significance of the author's conclusions with respect to hausmannite and a chromite spinel is discussed.

R. G. Wls.

BLACKMAN (M.), HAIGH (G.), & LISGARTEN (N. D.). *Investigations on the domain structure in hematite by means of the electron beam method*. Proc. Roy. Soc. London, 1959, **251A**, 117-126.

Magnetic shadow patterns obtained from hematite crystals from Elba, Etna, and Arizona are consistent with a well defined domain structure.

D. McK.

FYFE (W. S.) & VERHOOGEN (J.). *Covalent super-exchange in solid state physics*. Nature, 1960, **187**, 1108.

M. J. Le B.

MUAN (A.) & HAHN (W. C., Jr.). *Some energy relations in solid state reactions involving crystalline phases of variable compositions*. Journ. Phys. Chem., 1959, **63**, 1826-1830, 4 figs.

In the transformation of manganosite of low O<sub>2</sub> content under conditions where manganosite of high O<sub>2</sub> content is stable, hausmannite may form temporarily as a phase with an intermediate free energy.

W. T. H.

EARNshaw (A. W.) & SPROSON (J. C.). *Rheological properties of barytes suspensions*. Nature, 1960, **186**, 378-379.

D. McK.

TOCHER (F. E.). *The biaxial ray surface*. Min. Mag., 1960, **32**, 558-566, 19 figs.

Most published descriptions of the biaxial ray surface give the impression that it is indeed two surfaces touching at four points, one enclosed entirely within the other. The simplest description of the biaxial ray surface is: 'It is one continuous surface that intersects itself at the four singular points; the points of intersection divide the surface into two unequal portions of which one is contained wholly within the other'. The fact that one cannot pass from the outer to the inner portion of the surface without passing exactly through a singular point is shown.

W. S. M.

DWIGHT (A. E.). *Positions of thorium and uranium in the periodic table.* Nature, 1960, **187**, 505-506, 1 fig.

In crystal structures, thorium and uranium behave in a manner similar to the titanium group elements. This is not inconsistent with the recent theory that thorium, not actinium, is the parent element of the heavy-metal series.

M. J. LE B.

BRASSEUR (H.) & POTDEVIN (H.). *Considérations sur les propriétés et les constitutions de certains minéraux uranifères.* Zeits. Krist., 1960, **113**, 132-141, 4 figs.

The properties and chemical compositions of wölsendorfite, fourmarierite, becquerelite, billietite, vandendriescheite, and schoepite have been checked indirectly, and it is shown that their density, refractive indices, and cell size are related in a continuous series with their composition. In particular the formula  $\text{PbO} \cdot 8\text{UO}_3 \cdot 15\text{H}_2\text{O}$  for vandendriescheite is confirmed: in all these minerals, for each 2 U atoms there is a sub-cell of dimensions  $a''$  7.02,  $b''$  4.18,  $c''$  7.24kX. [M.A. 14-406]

R. A. H.

ROUBAULT (MARCEL) & COPPENS (RENÉ). *Sur une variation brusque et limitée de la radioactivité d'un massif granitique.* C.R. Acad. Sci., Paris, 1958, **246**, 3086-3089.

A sharp variation in the radioactivity of a granite mass reveals two bands several hundreds of metres long and 3 or 4 metres wide which join to form a Y. The activity reaches 140 c/s AVP. The plotted alignments might suggest the existence of uraniferous dykes. Actually the effect is due to concentration of monazite included in biotite (with 3 to 6% Th) as microscopic crystals.

E. J. & A. S.

TSUTSUMI (T.). *The radioactive accessory minerals and their distribution in some granites in Japan.* Mem. Coll. Sci., Univ. Kyoto, ser. B, 1959, **26**, 111-151, 3 figs., 1 table.

The distribution of radioactive accessory minerals in fifteen granite bodies was examined by the autoradiographic method. It was demonstrated that the minerals, in about 80% of the tests, occur in the interstitial spaces between the principal constituents.

M. S. J.

ZAGHLOUL (Z. M.). *Distribution of alpha-radioactivity in Lamorna granite, Land's End.* Trans. Roy. Geol. Soc. Cornwall, 1960 (for 1957-1958), **19**, 116-121, 1 fig.

The distribution of alpha-radioactivity between the constituent minerals of the granite from Lamorna quarry, Cornwall, is reported; 73% of the total  $\alpha$ -particle emission comes from accessory mineral inclusions, chiefly in the feldspars and biotite.

R. A. H.

HOSKING (K. F. G.). *A re-examination of an alleged stanniferous deer's-horn from the Cornish tin-bearing alluvium.* Trans. Roy. Geol. Soc. Cornwall, 1960 (for 1957-1958), **19**, 154-161, 3 figs.

A deer's horn reported to have 2.60%  $\text{SnO}_2$  [Coll. Cornwall, 1881] has been shown to be almost devoid of tin, 18 out of 19 samples having less than 10 p.p.m. Sn. It thus does not demonstrate whether cassiterite can be syngenetic with tin deposited in tin-bearing alluvials.

R. A. H.

YAMAOKA (K.). *On the occurrence and the minor elements in magnetite and hematite from the Sambagawa crystalline schist in Shikoku.* Journ. Japanese Assoc. Min. Pet. Econ. Geol., 1959, **43**, 297-308, 2 figs., 2 pls., 4 tables (Japanese & English summaries).

The distributions of the minor elements in magnetite and hematite crystals from the cupriferous iron sulfide deposits located in the Sambagawa crystalline schist zone have been studied.

M. S. J.

NAKAMURA (T.). *[Chlorite from the Ashio copper mine]* Journ. Min. Soc. Japan, 1960, **4**, 383-397, 4 figures, tables, (in Japanese).

Four specimens of chlorite which occurs as the gangue mineral in veins in the Ashio mine, Japan, were studied by X-ray powder diffraction and chemical analysis. Chlorite from the Cu and Zn-Pb veins in rhyolitic rock shows abnormally high values (0.94 to 0.95) of  $\text{Fe}^{II}/(\text{Fe}^{II} + \text{Fe}^{III})$ , while those in altered rhyolite show relatively low values (0.40 to 0.66). The cause of this difference is discussed. Characteristic features of chlorites from Cenozoic subvolcanic type deposits in Japan are also discussed in relation to their genesis.

M. S. J.

ŠMID (B.). *Roentgenometrická identifikace přirodích fosforečnanů mědi* [X-ray identification of natural copper phosphates]. Rozpravy Československé Akademie Věd, Praha, ser. MVP, 1957, **67**, no. 5, 67 pages (English & Russian summaries).

Powder photographs showed that the copper phosphates phosphorochalcite, lunnite, pseudomalachite, tagilite, and dihydrite are identical; the correct name is pseudomalachite. But libethenite is an independent mineral. These results were confirmed by chemical and physical analysis and by physical tests (hardness, density, optical properties) reported by ŠOTORNÍK in the same publication, 1957, **67**, no. 5, 1-66.

J.

PERMINGEAT (F.) & WEINRYB (E.). *Sur des inclusions cobaltifères dans la chalcopryrite d'Azegour (Maroc)* (Exemple d'utilisation de la microsonde électronique). Bull. Soc. franç. Min. Crist., 1960, **83**, 65-66, 1 fig.

clusions in chalcopyrite from the Azegour mine are found to be linnæite with composition Co 42.5, Cu 12, S, Fe 0.4, S 41.5, =99.4, i.e. a nickeliferous carrollite. Linnæite itself contains inclusions of blende and copyrite.

R. A. H.

ET (JESSIE M.). *What is plinthite?* Min. Mag., 1960, **32**, 455–458.

any specimens of plinthite, a mineral first described by Co. Antrim [Thomson, 1836] and later from Skye [1. 5–117], are reported to be mixtures of zeolites and hematite. The original analyses are of a ferruginous clay consisting of hematite, kaolinite, and montmorillonite, and the type specimen is a red clay in the montmorillonite group naturally mixed with hematite and a little analcime.

R. A. H.

AY-SZABÓ (I.). *Structure and density of glass.* Nature, 1958, **181**, 40–41.

C. H. K.

NE (P. A.). *Sand-glass 'sand'. Part II A. Analytical. Note on the mineralogy of 'Sand' from an 18th century hour-glass.* Antiquarian Horology, 1960, **3**, 68–70.

mineralogical study of the 'sand' from an 18th century hour-glass. The filling consists almost entirely of calcite, notably exhibiting form birefringence, with anomalously high refractive indices ( $n$  about 1.647) corresponding to calcite. This identification is confirmed (C. Tyler, 1960, II B) by staining with Mallory's triple stain. R. D.

UI (T.). *Mineralogical study on the stone in glass.* Min. Journ. [Japan], 1959, **2**, 355–374, 4 pls., 9 tables.

Mineralogical, optical, and X-ray properties of several stones in glass are described. Stones described are diopside, nepheline, nepheline, high-albite, celsian, corundum, hercynite, and spinel. The origins of these stones are discussed.

M. S. J.

RELS (R. M.) & THOMPSON (M. E.). *Oxidation of pyrite by iron sulfate solutions.* Amer. Journ. Sci., 1960, **258-A**, 57–67.

The rate of oxidation of pyrite from Bingham (Utah), Waterbury (Vermont), and Rio Tinto, Huelva (Spain) in acid sulfate solutions is in accord with the reaction  $8\text{H}_2\text{O} + 14\text{Fe}^{3+} = 15\text{Fe}^{2+} + 2\text{SO}_4^{2-} + 16\text{H}^+$ . This rate is proportional to the fraction of the pyrite surface area oxidized by ferric ions, which in turn is controlled by the ratio of ferric to ferrous ions available in the solution for adsorption on the surface of the pyrite.

H. W.

SUGGATE (R. P.). *New Zealand coals—their geological setting and its influence on their properties.* New Zealand Dept. Sci. Industr. Res., 1959, Bull. **134**, 1–113, 48 figs.

W. A. W.

POLANSKY (T. S.), DONALD (H. J.), & KINNEY (C. R.). *Structure of high-rank coals deduced from helium densities.* Nature, 1960, **186**, 792–793.

D. McK.

VAN KREVELEN (D. W.), GROENEWEGE (M. P.), & RIETVELD (B. J.). *Polynuclear aromatic compounds in coal.* Nature, 1958, **181**, 640–641, 1 fig.

C. H. K.

BOUŠKA (V.) & HAVLENA (V.). *Die Kohlenflöze d. Grube Jan Sverma, Lampersdorf bei Schatzlar u. geochemische Untersuchung ihrer Spurenelemente.* Rozprawy Čsl. Akad. Ved, 1959, **69**(3), (in Czech; German summary).

Spectrographic analysis of the inorganic constituents of the coal ash, organic analysis of the fusain components and the macro- and micropetrographic characters of the coal were combined with a view to the identification and correlation of the seams; under favourable conditions this proved successful.

J. N.

PADGET (P.). *The geology of the Mafingi mountains area of Northern Rhodesia and Nyasaland.* Trans. Geol. Soc. S. Africa, 1959, **62**, 139–145, 1 fig., 1 pl.

The stratigraphy, correlation, and tectonics of the area are described. The older Jembia River granulites are separated from the Mafingi Mountains Sequence by an unconformity. The granulites are tentatively correlated with the Ubendian of the Mozambiquian System and the Mafingi sediments with the Muva System.

M. M.

DE VILLIERS (JOHN) & SÖHNKE (P. G.). *The geology of the Richtersveld.* Geol. Survey Union of S. Africa, Mem. **48**, 1959, 1–295, 16 figs., 38 pls.

The geology of an area of approximately 3000 square miles is described. Seven major unconformities separate the sedimentary formations which range in age from Archaean to Recent. At least three periods of granite intrusion are distinguished. Igneous rocks show great diversity. The Alexander Bay diamond deposits are described; the authors discuss their origin and reject the theory that the bulk of the diamonds were transported from the kimberlite of the Kimberley district by the Orange river. A less remote source area is preferred.

M. M.

HARPUM (J. R.). *The concept of the geological cycle and its application to problems of Precambrian geology.* Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 9, 201-206.

Recognition of the geotectonic environment of any given rock unit, and hence its place within a geological cycle, may be regarded as one of the most valuable contributions to the interpretation of Precambrian geological history.

R. A. H.

WANGERSKY (PETER J.) & HUTCHINSON (G. E.). *Manganese deposition and deep water movements in the Caribbean.* Nature, 1958, **181**, 108-109, 1 fig.

C. H. K.

STRIDE (A. H.). *Recognition of folds and faults on surfaces beneath the sea.* Nature, 1960, **185**, 837.

D. McK

OVEREEM (A. J. A. VAN). *Sonic underwater surveys locate bedrock off the coasts of Billiton and Singaraja, Indonesia.* Geol. en Mijnbouw, 1960, new ser., Billiton issue, 464-471, 10 figs.

C. J.

WILSON (J. T.). *Some consequences of expansion of the Earth.* Nature, 1960, **185**, 880-2.

The geological and geophysical evidence for expansion of the Earth is examined; many features of the Earth's surface can be explained on the hypothesis that the circumference of the Earth has increased by 1100 miles during the past  $3.25 \times 10^9$  years at an average rate of 0.5 mm a year.

D. McK

# ABBREVIATIONS AND SYMBOLS

used in the text of abstracts

M.M. .. Mineralogical Magazine : M.A. .. Mineralogical Abstracts : A.M. .. American Mineralogist

## CHEMICAL & PHYSICAL-CHEMICAL

|                                                       |                                 |
|-------------------------------------------------------|---------------------------------|
| cation-exchange-capacity .. ..                        | c.e.c.                          |
| differential thermal analysis ..                      | d.t.a.                          |
| equivalent $U_3O_8$ .. ..                             | $eU_3O_8$                       |
| ethylenediaminetetra-acetic acid ..                   | EDTA                            |
| heat of formation (absolute temperature subscript) .. | $\Delta H_f$                    |
| ionic potential, e.g. .. ..                           | pH                              |
| insoluble residue .. ..                               | insol. res.                     |
| isotopes, e.g. .. ..                                  | $^{40}A$ , $^{40}K$             |
| loss on ignition .. ..                                | ign. loss                       |
| milliequivalent .. ..                                 | me.                             |
| microgramme .. ..                                     | $\mu g$                         |
| million-years .. ..                                   | m.y.                            |
| not determined .. ..                                  | n.d.                            |
| not found .. ..                                       | nt. fd.                         |
| not present .. ..                                     | nil                             |
| parts per million .. ..                               | p.p.m.                          |
| strength of solution, normal .. ..                    | $N$                             |
| — — — molar .. ..                                     | $M$                             |
| substances in ionic state                             |                                 |
| anions, e.g. .. ..                                    | $Cl^-$ , $SO_4^{2-}$            |
| cations, e.g. .. ..                                   | $K^+$ , $Fe^{3+}$               |
| valency, e.g. .. ..                                   | $Cl^I$ , $Fe^{II}$ , $Fe^{III}$ |

## CRYSTALLOGRAPHIC & STRUCTURAL

|                                                  |                                |
|--------------------------------------------------|--------------------------------|
| Ångstrom unit ( $10^{-8}$ cm) .. ..              | Å                              |
| crystal axes .. ..                               | $a$ , $b$ , $c$                |
| — face indices .. ..                             | (hkl)                          |
| — form indices .. ..                             | {hkl}                          |
| — zone indices .. ..                             | [hkl]                          |
| indices of X-ray diffractions ..                 | hkl                            |
| intensity, .. ..                                 | $I$                            |
| — relative .. ..                                 | $I/I_0$                        |
| interplanar spacing .. ..                        | $d$                            |
| mica structural polymorphs ..                    | $1M_1$ , $2M_1$                |
| Siegbahn units .. ..                             | kX                             |
| space group. These words will be written in full |                                |
| unit cell, formula units .. ..                   | $Z$                            |
| — — repeat distances .. ..                       | $a$ , $b$ , $c$                |
| — — reciprocal lattice lengths of edges .. ..    | $a^*$ , $b^*$ , $c^*$          |
| — — interaxial angles                            |                                |
| direct lattice .. ..                             | $a$ , $\beta$ , $\gamma$       |
| — — — reciprocal lattice..                       | $a^*$ , $\beta^*$ , $\gamma^*$ |

## OPTICAL

|                                 |                               |
|---------------------------------|-------------------------------|
| dispersion, e.g. .. ..          | $r > v$                       |
| extinction angle, e.g. .. ..    | $\gamma : c$                  |
| optic axial angle .. ..         | $2V$                          |
| — — plane .. ..                 | O.A.P.                        |
| refractive index, in text .. .. | refr. ind.                    |
| — — of isotropic mineral ..     | $n$                           |
| refractive indices              |                               |
| of uniaxial mineral .. ..       | $\omega$ , $\epsilon$         |
| of biaxial mineral .. ..        | $\alpha$ , $\beta$ , $\gamma$ |
| sign of biaxiality              |                               |
| negative .. ..                  | — or $2V_x$                   |
| positive .. ..                  | + or $2V_y$                   |

## PHYSICAL (other)

|                                                      |                   |
|------------------------------------------------------|-------------------|
| calorie .. ..                                        | cal.              |
| calorie, large .. ..                                 | kcal.             |
| cycles per second .. ..                              | c/s               |
| degree centigrade .. ..                              | $^{\circ}C$       |
| density .. ..                                        | $D$ (quote units) |
| — , relative, e.g. .. ..                             | $D_4^{20}$        |
| gramme .. ..                                         | g                 |
| hardness .. ..                                       | H.                |
| melting-point .. ..                                  | m.p.              |
| micron ( $10^{-4}$ cm) .. ..                         | $\mu$             |
| millimicron ( $10^{-7}$ cm) .. ..                    | m $\mu$           |
| pounds per square inch .. ..                         | lb/in $^2$        |
| soluble .. ..                                        | sol.              |
| specific gravity, terms of reference not known .. .. | sp. gr.           |
| wavelength .. ..                                     | $\lambda$         |

## SYMBOLS

|                                |             |
|--------------------------------|-------------|
| approximately equal to .. ..   | $\approx$   |
| equal to .. ..                 | $=$         |
| equal to or greater than .. .. | $\geq$      |
| equal to or less than .. ..    | $\leq$      |
| greater than .. ..             | $>$         |
| less than .. ..                | $<$         |
| not equal to .. ..             | $\neq$      |
| parallel to .. ..              | $\parallel$ |
| per cent. .. ..                | %           |
| per mille .. ..                | ‰           |
| perpendicular to .. ..         | $\perp$     |
| proportional to .. ..          | $\propto$   |

## Mineralogical Abstracts

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